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NUTRITION
IN HEALTH AND DISEASE

By
LENNA F. COOPER, EDITH M. BARBER
and HELEN S. MITCHELL

TENTH EDITION

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NUTRITION IN HEALTH AND DISEASE

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BY

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TENTH EDITION, REVISED AND RESET

128 ILLUSTRATIONS AND 4 COLORED PLATES

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TENTH EDITION

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PREFACE TO THE TENTH EDITION

Never before has so great an emphasis been placed on food and nutrition for the benefit of mankind. Progress in nutrition research has been so rapid and there have been so many new applications that a textbook such as this requires frequent revision to interpret the newer knowledge of nutrition. The tenth edition emphasizes this new and broader concept of nutrition and its importance to everyone. At the same time, the authors have attempted to keep a simple and direct approach in the discussion of each subject.

The present edition appears in a completely new format with double-column page for ease of reading. The subject matter has been consolidated into four parts, conforming in general to the tentative "Manual for Teaching Nutrition and Dietetics to Nurses" prepared by the American Dietetic Association.

Part One, Principles of Nutrition, completely revised, includes an introductory chapter on the history of nutrition and present-day world concepts. Chapter 2 discusses the broad scope of nutrition and its importance in the public-health program. A completely new set of food-value charts have been included in the chapters on individual nutrients. These charts picture graphically the contribution made by average servings of foods toward the day's requirement of each nutrient. Other new graphic charts, illustrations and summaries have been included in this edition as an aid to the student in his grasp of the subject. A new chapter on planning family dietaries to conform to recommended allowances will be of great practical value. The last four chapters in Part One deal with the specific needs of infants, growing children, mothers and other adults. Special attention should be paid to the completely new text of Chapter 18, Nutrition for Adults, Young and Old, because it is a subject too often ignored.

Part Two, Diet in Disease, comprises seventeen chapters and has been largely rewritten to bring the subject matter up to date. With due recognition of different regimes recommended in medical literature, the use of the basic dietary pattern is recommended throughout to ensure that all diets will be adequate nutritionally, even when restricted because of specific diseases. Special emphasis is given to high protein diets and to the use of hydrolysates and amino acids in the treatment of debilitating diseases and in convalescence. New developments in the management of diabetes, diseases of the liver and the biliary tract and the low sodium diet in treatment of hypertension have been given special consideration.

Part Three, Food Selection and Preparation, consolidates the subject matter formerly discussed in Parts Four and Five of the book, thus making it easier to co-ordinate the discussion of food materials and their preparation. Emphasis is laid on the nurse's own food problem as well as upon the adaptation of a normal diet for the patient. The small-quantity recipes, of which there are far more than can be included in the hours devoted to laboratory work, will be of use whenever there is a problem of cooking for one or two, whether for the patient or for the nurse in her own home after graduation.

Part Four, Tabular Material and Special Tests, has been completely revised, as have the other parts of the book, with special emphasis on simplification and usability. Table 1, which has long been recognized as an indispensable part of this book, has been completely revised and reset, the decimal points having been eliminated wherever possible without sacrificing accuracy. This should encourage students to use the table more freely. Table 2 offers a short method of calculating dietary values when the more accurate values in Table 1 are unnecessary. Other tables, such as the Sodium Content of Foods, have been added in line with new emphases in diet therapy, and new Metropolitan-Life-Insurance tables of Ideal Heights and Weights for Men and Women have been included, as well as the table of average weights.

Attention has been given throughout this revision to helping the student put emphasis on important items and supplement the material in the text. The review questions have been carefully revised and include situations which utilize the material of the chapter. The much expanded list of references at the end of the book will allow the student to delve deeper into any subject in which she is interested. The glossary has been revised and expanded to give the student a concise definition of technical words appearing in the text.

The authors have aimed to compile a textbook which will serve not only as an aid to the student during the course, but as a reference book for the dietitian, the graduate nurse and the homemaker.

In this, as in previous editions, experts in specific fields have been engaged in the preparation of certain chapters and in reviewing and criticizing the text as a whole. (See specific acknowledgments.)

PREFACE TO THE FIRST EDITION

Long association with medical institutions both as dietitians and as teachers of dietitians and nurses has led the authors to believe that the present status of the subject of dietetics demands a somewhat different emphasis from that formerly placed upon it. Our experience shows also that there is a real need for a single volume which may serve as a hand-book on the subjects of nutrition and diet in disease, two subjects so intimately and vitally connected as to necessitate their being inseparably united in the mind of the nurse. At the request of former students and others who later became teachers of nurses in the field of dietetics, this volume has been prepared.

This book presents the newer ideas in both the principles of nutrition and the practice of dietetics, based upon the most recent experimentation and study as well as upon the established knowledge of earlier research findings.

It includes the prevailing practices of leading physicians in the field of nutrition as applied to health and disease. When physicians differ greatly in their dietary practices, the authors have endeavored to present the consensus of opinion, where such exists, or the prevailing regimens, with the scientific principles involved. Throughout the book the preventive and remedial aspects of nutrition have been emphasized. Not only the needs of the bedside nurse have been kept in mind, but also the problems of the public health nurse who must cope with poverty, racial preferences, and established food habits as complicating factors.

The content of the book is arranged to cover two courses. Parts One, Two, and Four comprise the subject matter for the first course: Principles of Nutrition and Cookery. Part One consists of fifteen one-hour class periods, devoted to the principles of nutrition. Part Two consists of fifteen short lessons on foods and is intended to cover the first half hour of a two-hour laboratory period, the remaining one and one-half hours being devoted to food preparation, the recipes for which are supplied in Part Four. It will be noted that these recipes are generally for small quantities, designed for the use of the nurse who must cook for one patient.

Part Three consists of fifteen one-hour lectures constituting the second course: Diet in Disease.

While the book is written with the needs of the nurse in mind, the authors believe it is adapted to the needs of the liberal arts student whose crowded program does not permit of more than two or three semester hours for a course in Foods and Nutrition. It is hoped that even the busy housewife whose responsibilities to her family involve the planning of menus, the buying of food, as well as the preparation of it, will also find much of value in it.

It is also the hope of the authors that the book may contribute to the sum total of knowledge and to the interest in the science of nutrition as the cornerstone in the health of the individual, and ultimately, the nation at large.

THE AUTHORS

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Part One

PRINCIPLES OF NUTRITION

INTRODUCTION

A knowledge of food and nutrition principles is the best kit of tools for the building of positive health. Only recently has nutrition been recognized as a distinct science with organizations and publications devoted to nutrition research and its application for human betterment.

Cannon [1] draws our attention to "the wisdom of the body" by his comment: "When we consider the extreme instability of our bodily structure, its readiness for disturbance by the slightest application of external forces and the rapid onset of its decomposition as soon as favoring circumstances are withdrawn, its persistence through many decades seems almost miraculous. The wonder increases when we realize that the system is open, engaging in free exchange with the outer world, and that the structure itself is not permanent but is being continuously built up again by processes of repair."

There are still numerous unexplored fields in the science of nutrition that may eventually yield information of value in promoting greater longevity, freedom from nutritional disturbances, and an approach to optimum health at all ages.

Nutrition today takes its rightful place as a full-fledged member of the health and the medical sciences. It is no longer merely a branch of physiology, chemistry or pediatrics. Nutrition has become a mighty tool: it can be wielded by diplomats for better health the world over and by every individual for better personal health.

Part One deals with the principles of normal nutrition and their application to people of all ages and conditions. Chapters 1 and 2 emphasize the importance of nutrition and the changing concepts of it, as well as the improvement that can be made in general health and efficiency by use of present-day knowledge of the science. The remaining chapters deal with the specific food nutrients and how to make nutrition information function.

The application of the principles of nutrition in everyday living calls for the co-operative efforts of research scientists, nutritionists, dietitians, nurses and homemakers, as well as of every person who eats to live. Nutrition education must reach the individual, the family and the community; must take into account the economic status of the individual or the family, food costs, living conditions, racial and religious food preferences. All these topics are discussed. Nutritional needs during pregnancy and lactation, infancy, growth, adult life and old age require special consideration. This is given in Chapters 15 to 18.

The application of the principles of nutrition to abnormal conditions is dealt with in Part Two, "Diet in Disease."

---

[1] Cannon, Walter B.: The Wisdom of the Body, New York, Norton, 1932.

1

Nutrition and Optimum Health

Chapter Topics

HEALTH AND EFFICIENCY
THE MEANING OF NUTRITION
NUTRITION, A NATIONAL AND AN INTERNATIONAL ISSUE
PRIMITIVE MAN AND HIS FOOD HABITS
DAWN OF THE EXPERIMENTAL METHOD
EVOLUTION IN NUTRITION RESEARCH
CONTEMPORARY DEVELOPMENT OF NURSING AND DIETETICS

HEALTH AND EFFICIENCY

Good health and efficiency depend throughout the whole life span upon food adjusted to meet the needs of the body. This need for adjustment starts with the pregnant woman and nursing mother and infant, and continues through old age. These specific needs will be discussed in Chapters 15 to 18.

In Great Britain[1] during World War II it was demonstrated that "improvement of the diet of workmen whose diet was not previously up to the standard for health was followed by increased output without any conscious increased effort and also by a reduction in the number of accidents." In the United States the importance attached to proper feeding of industrial workers has come to be appreciated to the extent that provision of adequate food for employees will continue to be emphasized where there is progressive plant management. The men in the armed forces in general received rations that equaled or exceeded recommended allowances. Although complete statistics for World War II are not yet available, the health and the general stamina of the men were better than in any previous war. There was room for improvement in health in the physically fit men of this country and good food had a big part in promoting this improvement.

For the nurse, good health is a personal asset, because it enables her to follow her profession efficiently and with material profit. It is her bank account, upon which she may have to draw heavily. While her health balance depends quite largely upon her family inheritance and habits formed in childhood, she will be able to increase her reserve by the proper practice of healthful living. At the same time she will be in a position to encourage her patients to follow a normal regimen. Those who practice what they preach are the most effective preachers.

The life span may be increased by 10 per cent when the adequate diet is appropriately enriched. This has been shown by Sherman[2] in carefully controlled experiments on 27 generations of rats fed on an adequate diet. This increase would indicate not only the possibility of extending the average longevity of the human race but the "greater extension of the prime of life, in that maturity is expedited and senility deferred."

---

[1] Orr, Sir John Boyd: Brit. M. J. Jan. 18, 1941, p. 73.

The real job of planning for the health and the efficiency of future generations comes down to the formation of good health habits in today's children. As Heiser[3] has stated it:

"Probably other factors besides inheritance account for tall parents often begetting tall children. It may be because those households serve foods which make for growth."

The schools, as well as the home, have a responsibility, and they do not always assume it. Teachers, health supervisors and school nurses in particular are in a strategic position to influence both children and parents in good health practices by teaching and practicing them consistently.

THE MEANING OF NUTRITION

Lusk[4] wrote in 1914:

"The workshops of life require fuel to maintain them, and a necessary function of nutrition is to furnish fuel to the organism that the motions of life continue. Furthermore, the workshops of life are in a constant state of partial breaking down and materials must be furnished to repair the worn-out parts. In the fuel factor and the repair factor lies the essence of the science of nutrition."

The term nutrition has been variously defined since then but is generally used in two senses: (A) the condition of the body, which is often designated as nutritional status, and (B) the supplying of the body with necessary food nutrients. Rose[5] suggested that a distinction be made between nutrition, which deals with the scientific laws governing the food requirements of human beings for maintenance, growth, activity, reproduction and lactation, and dietetics, which deals with the practical application of these laws to individuals and groups in health and in sickness. In line with this concept, a nutritionist is one who investigates and gives information on nutrition to others so that they may use it, while a dietitian is one who plans diets and supervises or administers food service.

Stare and Davidson[6] have defined more explicitly the meaning of good nutrition. This is as follows:

"Good nutrition for an individual implies that he receive and utilize a suitable metabolic mixture of all substances necessary for health. This can be obtained only from food selected, processed, prepared, consumed, absorbed and utilized so that it furnishes in optimal amounts the individual's essential nutrients. Such a diet must contain protein, fat, carbohydrate, certain minerals and vitamins, and water in optimum amounts. The optimum allowance which is recommended for each nutrient should be much greater than the minimum requirement of that nutrient. That is, provision must be made not only for actual requirements but also for variations from the 'normal' both in health and in disease, for the accumulation of some 'reserves' and for differences in actual food intake due to food habits, individual tastes and variations in economic status."

---

[2] Sherman, H. C.: J.A.M.A. **97**:1425, 1931.

[3] Heiser, V. G.: Collier's **98**:18, 1936.

[4] Lusk, Graham: The Fundamental Basis of Nutrition, New Haven, Yale, 1914.

[5] Rose, M. S.: Nutrition Abstr. & Rev. **4**:439, 1935.

[6] Stare, F. J., and C. S. Davidson: J.A.M.A **127**:985, 1945.

This concept is not the opinion of a few persons but the culmination of years of study and research. The application of this knowledge of nutrition has been gradually improving the American norm of health and physique since very soon after the turn of the century. The responsibility of every student of health today is to take an active part in applying the results of scientific research in order that there may be a fuller and a more far-reaching nutritional improvement of human life in the future.

NUTRITION, A NATIONAL AND AN INTERNATIONAL ISSUE

Nutrition, a big word in postwar vocabularies, looms large in the spheres of agriculture, business and labor. Committees representative of these three interests have done constructive planning and have published a report entitled "A Nutrition Program for the Nation." "No group in the nation—certainly not agriculture or business or labor—has any interest in keeping part of the people underfed or malnourished" is an opening statement in this pamphlet, which goes on to say: "The common national interest in better nutrition can be stated as follows:

"First and foremost: It makes better human beings, which is the principal object of civilization.

"Second: Not only does it reduce greatly the amount of suffering and misery of people who are sick or half sick, but it increases incalculably the satisfaction and the enjoyment in the experience of life.

"Third: It increases the output of the individuals of society by making them more productive, and makes it possible for them to have more goods and services, or work fewer hours, or more likely some of both.

"Fourth: It accomplishes this last result particularly by increasing the proportion of productive years in a lifetime. It broadens out the span of life in the working years round the prime of life."

This concept of what better nutrition can mean to a nation is not new to those who have a knowledge of the subject, but a broader interest and a new emphasis are sounded in this and other recent calls to action: the nutrition problem is not only national, it is international.

The importance of food in making peace terms work is emphasized by the fact that the world's first international organization was set up to help consumers and food producers plan for a better-fed world. The United Nations' Food and Agriculture Organization (FAO) grew out of the meeting held at Hot Springs, Va., in May, 1943, and was launched as a full-fledged international organization in Quebec, Canada, in October, 1945. FAO is concerned not so much with the theories and the terms of peace as with the establishment of conditions that will help to make peace.

Two thirds of the world's people never have had enough to eat or the right kind of food to promote health. In the past it was accepted as a foregone conclusion that hunger was the inevitable lot of a large proportion of mankind, even though two thirds of the people in the world were engaged in agriculture. Even those who produce the food do not get enough of it or the right kind of it. Today, science can provide information on how to produce enough food to feed the world, and FAO is a first step toward putting that information to work by joint planning.

The objective of FAO according to a timely editorial[7] on the subject "is to dig out agricultural and food facts on a world-wide scale, bring them together, analyze them, interpret them in terms of their best use to all concerned, and to make them available to all member nations. The Food and Agriculture Organization can recommend national and international action but has no authority to enforce its recommendations. Its force lies in its appeal to the practical reason and conscience of people."

It is noticeable that nutrition is mentioned and emphasized repeatedly in the FAO articles of organization. The science of nutrition ties in on the one hand with the agriculture of nations and on the other with the nation's health; thus the FAO becomes a clearinghouse for nutrition problems of world-wide interest. To quote again from the editorial just mentioned:

"It will be the job of the Food and Agriculture Organization to bring together information on all phases of nutrition and weave it into the broad fabric of science and economics to make recommendations for a better-fed world. These recommendations can then be passed on to nations, upon request, and advisory aid can be given them in the establishment of better records of their dietary needs, . . . and in making surveys that will, in turn, supply broader information to other countries to fill in the world picture of nutritional science."

The wartime food policy of Great Britain with the resultant improvement in national health is conclusive evidence that national planning for better nutrition pays dividends. The program was a matter of careful planning of home production, of imports, reduction in waste and an equitable distribution of the foods available. Moreover, the kind of food produced or imported was planned to meet the nutritional needs of the population and was not left to chance as formerly. In Scotland, the five years of altered dietary habits resulted in no adverse influence on the health of the population. During these same years there was a reduction in infant mortality, in stillbirths and in maternal death rates, and the productivity per head was the highest in the world. From height, weight and growth data the condition of the children was also "highly satisfactory," according to the reviewer, who concludes as follows:[8]

"This example of governmental planning from England may well serve as a pattern for international planning for the application of the science of nutrition to the difficult feeding problems to be met in the whole of Europe and in the Far East in the days to come. For . . . 'if we do not plan for peace with a fairer distribution of the resources of the world, we must plan for war. But plan we must.' "

Can a nurse, a social worker, a homemaker or anyone interested in one's own health, that of one's family or community or of mankind in general afford not to know something about this timely subject?

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[7] Consumers' Guide **11**:3, 1945.

[8] Editorial: Nutrition Rev. **3**:249, 1945.

PRIMITIVE MAN AND HIS FOOD HABITS

Food has always been recognized as one of the most vital necessities of life. Man's interest in its nutritive qualities began before the dawn of civilization, and it has continued to grow throughout the ages. This interest did not develop into a distinct science of nutrition until the twentieth century.

Egypt. On an old millstone found in Egypt several years ago there is engraved what is perhaps the oldest manuscript in existence. It is a copy of an old papyrus that dates back to about 3400 B.C. It was written as a hymn of praise to the God Ptah, extolling him as the supreme Sun God. The manuscript reveals the existence of a government that apparently was vitally interested in food, for it reads:

"And thus the stations [official positions] were made and the functions [of government] were assigned, which furnished all nutrition and all food. . . . Everything has come forth from him, whether food, or nutrition, or food of the gods, or any good thing." [9]

Babylonia. The interest of the ancients in food and in dietary matters is shown, it will be remembered, by the Biblical story of Daniel and his three companions who were chosen to stand before King Nebuchadnezzar of Babylon as "youths in whom there was no blemish . . . and understanding science." They were to receive daily a portion of the king's dainties and his wine. But Daniel objected to this regimen, much to the consternation of the chief eunuch, who feared the king's displeasure if these young men's countenances should be "worse-looking than those of other youths." Daniel then instituted what was probably the first dietary experiment when he persuaded the chief eunuch to allow him and his companions to be given, for a period of ten days, a diet of pulse (legumes, such as peas, beans and lentils) in place of the king's meat, and water in place of his wine. It will be remembered that at the end of the ten days, they looked so well that they were allowed to continue in their own way, and at the end of their three years' training, the king found them "ten times better than all the magicians and enchanters that were in all his realm." Thus we see a beginning, at about 600 B.C., of an appreciation of things "scientific," even though a very meager fund of knowledge existed. Confidence in magic was beginning to wane.

Greece. Primitive man soon learned to associate his diseases with his food supply. Even the medicine man of the time was primarily interested in the food of the patient. Having nothing but his own experience as a guide, it is not surprising that many erroneous ideas prevailed. There was no one to challenge seriously these ancient superstitions until the Greek Hippocrates arrived on the scene of action, about 460 B.C. He, however, does link the development of medicine to that of nutrition, for he [10] writes:

"Let us inquire therefore what is admitted to be medicine. . . . To me it appears . . . that nobody would have sought for medicine at all, provided the same kinds of diet had suited with men in sickness as in good health. . . . For cheese does not prove equally injurious to all men, for there are some who can take it to satiety without being hurt by it in the least, but on the contrary it is wonderful the strength it imparts to those with whom it agrees; but there are some who do not bear it well, their constitutions are different, and they differ in this respect, that what in their body is incompatible with cheese is aroused and put in commotion by such a thing; and those in whose bodies such a humor happens to prevail in greater quantity and intensity, are likely to suffer the more from it. But if cheese had been pernicious to the whole nature of man, it would have hurt all. Whoever knows these things will not suffer from it."

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[9] Breasted, J. H.: The Dawn of Conscience, New York, Scribner, 1933.

[10] Quoted by Lusk, Graham: Clio Medica. Nutrition. New York, Hoeber, 1933.

DAWN OF THE EXPERIMENTAL METHOD

While Hippocrates challenged the old order of things, it was not until after the beginning of the Christian era that the experimental method really came into vogue. Galen (A.D. 130 to 200), after finishing the medical course of his time, went from Greece to Alexandria in Egypt, where he was allowed to dissect the bodies of executed criminals. Later he experimented upon hogs and, as a result of his experiments, concluded that the stomach was a place in which food could be resolved into particles sufficiently small to be absorbed.

Experimental research as a necessary factor in the study of medicine was given a great impetus by Galen. However, for more than a thousand years after his death little progress was made. During the sixteenth century Leonardo da Vinci of Italy contributed to the fundamentals of medicine his unsurpassed anatomic drawings. About the seventeenth century progress in medicine began in reality: Harvey demonstrated the circulation of the blood. In the eighteenth century Lavoisier, a French scientist, became interested in the study of metabolism, or what becomes of the food after it is digested in the body. Lavoisier was followed in the nineteenth century by such illustrious men as Liebig, Boit and Rubner. This brings us to modern times with a world-wide interest in nutrition research. Lusk, Chittenden, Mendel, McCollum, Murlin, Benedict, Sherman and M. S. Rose are among the many outstanding men and women who have contributed to the present knowledge in this field.

EVOLUTION IN NUTRITION RESEARCH

Early in the twentieth century research workers in food chemistry and in physiology in Europe and in America became aware that there was something in natural foods other than protein, fat, carbohydrate and minerals. Using rats and other animals as experimental subjects, they demonstrated the presence and the necessity of "accessory food factors," later called vitamins. They also demonstrated the need of good-quality protein for the growth of animals, and that quality depended upon the protein constituents amino acids. Later the concept of the number and the type of minerals needed for growth came to include trace elements as well as those present in larger amounts. Then followed in rapid succession studies in essential fatty acids, hormones, enzymes, chemical regulators and intermediary products of digestion and metabolism.

Research methods and scientific tools have kept pace with changing concepts. First, the chemist analyzed foods for protein, fat, total ash and moisture, and assumed the balance to be carbohydrate in nature. Then he analyzed the ash for its specific mineral constituents. Later, animal-feeding experiments supplemented the chemist's data by showing that the hitherto unrecognized food factors were necessary for growth and that the rate of growth could be used to measure the presence of such substances—bio-assays. Animals were also used for studying the end products of metabolism of specific substances.

Much of this early research was sporadic, individual investigation. Each scientist chose his subject and his method of approach with results that might or might not compare with those from other laboratories. It also became apparent that observations made on one species of animal might not be true for others, or for man. Thus the use of many different animals and human subjects necessitated development of new and suitable methods. The intricate jigsaw puzzle of nutrition was being constructed the hard way, but eventually several pieces fitted together and a more co-ordinated plan of research became possible. Groups of laboratories reached agreement as to the problems that needed investigation and the methods to be used in their investigation, and pooled their efforts to obtain quicker and more conclusive results. The National Research Council and the Office of Experiment Stations are two agencies that have taken a hand in this coordinating effort in the field of nutrition.

More recently it was realized that too few of the new scientific facts about nutrition were really being put to work for human betterment because of firmly established food habits. Therefore, research in the food habits of individuals and population groups, and in what happens to food between producer and consumer, has broadened the approach to applied nutrition. Methods for the study of food habits were explored by the Committee on Food Habits of the National Research Council, and a manual published in 1945 will help to co-ordinate future research in this field.[11]

Agriculture is promoting research in the nutritive quality of foods grown under different conditions. The United States Plant, Soil and Nutrition Laboratory at Ithaca, N. Y., and many other laboratories are devoting attention to the effect of soil constituents, fertilizers, moisture, climate and hours of daylight upon the nutritive quality of food plants. Even seed catalogues are beginning to list the vitamin and the mineral content of different varieties of vegetables for the information of the home gardener. In the future, fruits and vegetables of highest nutritive value, rather than the fanciest pack, may bring premium prices in the market if the public continues to grow nutrition-conscious.

As the scope of fundamental and applied research in nutrition broadens, the combined skills and knowledge of many different sciences are necessary. In a review article Macy [12] summarized the present situation:

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[11] Manual for the Study of Food Habits, Committee on Food Habits, National Research Council, Washington, 1945.

[12] Macy, I. G.: Nutrition Rev. **3**:98, 1945

"Nutrition research is conducted *in* the laboratories of hospitals, schools, agricultural-experiment stations and food manufacturers *with* human subjects, animals, plants, micro-organisms, *by* chemists, physicists, biologists, physiologists, bacteriologists, biometricians, physicians, home economists, dietitians, sociologists, economists and agriculturists. Scientists working in different specialties have pooled their efforts to obtain more complete knowledge of the foods we eat and of the physiologic processes that utilize them. Indeed, in its development, application and progress, the science of nutrition embraces most, if not all, of the sciences."

The results of nutrition and biochemical research are applicable both in normal and in abnormal conditions. The discovery of thyroid extract, adrenalin, insulin and, more recently, liver extract has thrown light on the way in which food is utilized. Insulin has come to make tolerable and profitable the life of the diabetic; and because of liver extract the plight of the sufferer from pernicious anemia is no longer hopeless.

These and many other facts have been contributed by these modern magicians, the research workers. McLester[13] says:

"The great discoveries of recent years have excited the interest of everyone, laymen and physicians alike, and today medical men are keenly alive to the vastly important part which nutrition plays in the prevention and treatment of disease. A radical change in the conception of the nutritive needs of the sick person has come about."

CONTEMPORARY DEVELOPMENT OF NURSING AND DIETETICS

History seems to indicate that Florence Nightingale was as much the mother of the profession of dietetics as the founder of the nursing profession. Her biographer, Sir Edward Cook, reports that when she went to Scutari at the time of the Crimean War in 1854 she was at once confronted with the food problem. Forty-five hundred soldiers were lying on cots in corridors and elsewhere, the sick and the wounded occupying from three to four miles of space. The kitchen for these thousands of men was located at the extreme end of the hospital. It took from three to four hours to serve the ordinary dinner, and there were no facilities for preparing delicacies for the critically ill. It is reported that within ten days after her arrival not only had she established two "extra diet kitchens" but she had fitted up an impromptu kitchen on a staircase, and from these diet kitchens 800 men were supplied daily with such foods as chicken broth, arrowroot gruel and other sickroom delicacies. In addition, she organized the laundry. Then she went to the battlefront—to the hospital at Balaclava. "She was anxious to inspect these hospitals, to increase the efficiency of the female nurse establishments and, in particular, to introduce those washing and cooking arrangements which had been productive of so much benefit at Scutari."

In her own "Notes on Nursing" and "Notes on Hospitals," she makes many comments that are still apropos. After discussing the importance of variety and the proper cooking of food, she says:

"I have often been surprised by the

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[13] McLester, J. S.: J.A.M.A. **103**:383, 1934.

primitive kitchens of some of our civil hospitals with which little variety of cooking is possible. It shows how little diet and cooking are yet thought of as sanitary and curative agents. . . . It is singular that while so much care is taken to provide good medicine properly made up, so little care is bestowed on the cooking of that which is of more importance than most medicines."

The nursing profession from its beginning and until quite recent times was responsible for the dietary work in hospitals. The nurse to whom the special phase of work was assigned was often called a dietist; in fact, this term was used in some branches of government work until recent years. A movement was started about 1890 in some of the hospitals in the eastern part of this country to place a woman specially trained in foods and in food preparation in charge of the special diet kitchen—at first to teach their nurses how to prepare foods for the sick. A graduate of a cooking school in the East was employed by Johns Hopkins Hospital to instruct its nurses in cooking. She was probably the first resident teacher of sickroom cookery. A little later, in the spring of 1893, the Presbyterian Hospital in Philadelphia decided to start a diet kitchen in which the nurses would be taught to cook, and at the same time the patients in the private wards would be given the food prepared by these nurses. This diet kitchen was presided over by a graduate of another cooking school in the East. She was given the title "superintendent of diet." Just when the word dietitian was first applied to this type of food specialist is not known, but it must have developed within the following ten years.

Threefold Responsibility in Dietary Treatment. It is not surprising, in view of the rapid advancement in the science of nutrition and in the administrative phases of feeding large numbers of sick people, that specialists in this field of knowledge should have invaded the hospital field. Nevertheless, the dietary treatment of the sick is a threefold responsibility that rests upon the medical, the nursing and the dietary departments. Only by perfect teamwork can the best results be obtained.

The decision as to what the patient shall be fed is frequently left to the private-duty nurse. It is highly important that she have more than a brief course in this subject, and that the sum total of her knowledge of dietetics be not limited to liquid, soft, and light diets. She should be able not only to fill a dietary prescription accurately but to observe its effects and report intelligently on them to the doctor. She must also take account of the psychologic factors affecting appetite and digestion, and make every effort to induce a patient to eat essential foods.

To know foods and to use them as a means of maintaining and restoring health, just as she knows the uses and the effects of medicines, is the big objective in the nurse's study of dietetics. To know how to make variations from the normal diet in diseased conditions, she must know food values so as to be able to keep her patient well-nourished while adjusting to restrictions imposed by disease.

2

Better Nutrition—A Challenge

Chapter Topics

- IMPROVEMENT POSSIBLE
- PREVALENCE OF NUTRITIONAL DEFICIENCIES IN THE UNITED STATES
- IMPROVED NUTRITIONAL STATUS FOLLOWS BETTER FOOD
- POPULAR GUIDES FOR BETTER NUTRITION
- IMPROVED FOOD CHOICES FOLLOW NUTRITION EDUCATION
- NUTRITION IN COMMUNITY HEALTH PROGRAMS

IMPROVEMENT POSSIBLE

Food and nutrition experts have been preaching and teaching the value of better food for decades. The results of their efforts are evident but uneven and difficult to evaluate. Some evidences of their accomplishments are given in the following two sections of this chapter. The National Nutrition Conference, held in 1941, stimulated a more active interest among both professional and lay groups and encouraged implementation of nutrition programs at federal, state and local levels. The Nutrition Conference report concluded with the following comments regarding the implications of such a national nutrition program: [1]

"There seems no reason to doubt, on the basis of present evidence, that just as, by the use of modern medical science, we have conquered diseases that took an enormous toll of life in the past, so by the use of the modern knowledge of nutrition we can build a better and a stronger race, with greater average resistance to disease, greater average length of life and greater average mental powers.

"This can be done by the conquest of hunger—not only the obvious hunger man has always known, but the hidden hunger revealed by the modern knowledge of nutrition."

The problem now is to put this knowledge to work so that the foregoing prediction may be realized. Scientific nutrition cannot solve the problem until people are more generally aware that there is room for improvement in the physical status of people who think of themselves as well. Experiences with groups of persons in institutions where the physical status was observed and recorded before and after making an improvement in the type of food served have demonstrated that a change in food alone can make a big difference.

Making food attractive tempts people to eat, and making nutrition information attractive tempts people to use it. Leaders must first be shown that the use of nutrition information is worth while for themselves, then they can more successfully pass it on to those with whom they are working. In the following three sections of this chapter an attempt is made to give professional workers some good arguments that show why nutrition education is necessary and what it can accomplish. Some of the instances cited are suitable for use in popular talks to lay groups. It does little good to start giving people nutrition information before they are persuaded that they themselves can profit by it and that it is not difficult to put into practice.

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[1] Proceedings of National Nutrition Conference, 1941, Nutrition Division, Office of Defense Health and Welfare, Washington.

PREVALENCE OF NUTRITIONAL DEFICIENCIES IN THE UNITED STATES

A review of the prevalence of impaired nutrition and its significance affords concrete evidence and information that every health worker can use to advantage. The time has come when chronic ill-health cannot be accepted complacently without checking on food habits as a possible contributing factor.

The national nutrition program emphasized the need for such a review to provide workers in all phases of the program with the facts about nutrition in the United States. The National Research Council committee report on "Inadequate Diets and Nutritional Deficiencies in the United States, Their Prevalence and Significance" [2] met that need admirably in 1943. The committee assembled and re-evaluated the results of dietary surveys and nutritional appraisal of populations groups reported in widely scattered scientific journals during the preceding decade. The review also contains considerable material previously unpublished, and is a valuable reference for public-health workers and nutritionists.

Attention is also called to a distinction that should be made between the extent to which diets are inadequate, as shown by surveys, and the prevalence of deficiency states, as measured by thorough health and medical examinations of individuals and/or measurements of nutritional status by recently developed technics. Many more dietary surveys have been made, and of larger groups, than have been possible for nutritional-status studies. The latter demand more time, more skilled personnel and more elaborate equipment. The ideal plan would be to have dietary surveys parallel nutritional-status studies in order to obtain evidence of the degree of correlation. Accurate figures for minimum dietary requirements and optimum dietary allowances can only be arrived at by such co-operative studies.

Dietary surveys have indicated, as often quoted, that one third of our population are eating diets below the optimum level in one or more respects. This does not mean that one third of the nation is malnourished, as has sometimes been the faulty conclusion drawn from dietary surveys. Diets judged to be faulty by present standards may be adequate for some individuals in a group, but by and large they predispose the average member of such groups to the possibility of physical ills and defects resulting from the habitual undernutrition.

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[2] National Research Council Bulletin 109, Inadequate Diets and Nutritional Deficiencies in the United States, Washington, Nov., 1943.

The summary of this bulletin states that "all evidence from numerous surveys over the past ten years to the present (1943) among persons of all ages in many localities is without exception in complete agreement that inadequate diets are widespread in the nation.

"It has long been recognized that other circumstances besides deficient diet impair nutrition. Certain so-called conditioning factors, such as physical exertion, light, trauma of several kinds and disease, raise the requirements for essentials. Therefore, adequate intake is an individual matter related to the conditioning factors in operation. If these factors are sufficiently severe, even optimum intake may not completely protect against their force during the period of maximum operation. It is evident that many factors affect nutritional status.

"But evidence that deficient diet or conditioning factors are in operation at some particular point of time gives only a slight and incomplete conception of the full scope of their influence and effects. The frequency and duration of their operation is extremely important. Thus time, which for persons is age, is a significant factor. Few people eat at an adequate diet every day during their lifetime. Rather, there are numerous or protracted periods when the diet is faulty. Similarly, few people escape the operation of conditioning factors at frequent or lengthy periods in their life. The repeated or protracted operation of faulty diet or various conditioning factors slowly leads to cumulative effects in deficiency states.

"All the data from numerous surveys with new methods among persons of all ages in many regions are entirely in accord in showing that deficiency states are rife throughout the nation. Relatively few are the traditional severe, acute types. Most are milder in intensity and gradual in their course. Predominantly they are subacute or chronic states—some marked, but very many mild or moderate."

The application of existing knowledge of the significance of optimum nutrition for health is slow, as are all preventive or prophylactic measures in public health. The benefits lack drama and can be measured with difficulty only after years of work. There have been premature and exaggerated claims for the immediate benefits to be derived from optimum versus merely adequate nutrition. "Nevertheless," concludes this report, "keeping in mind the view that buoyant health, not just passable health, is the objective of modern health philosophy and practice, the evidence now available, incomplete as it may seem, leads to but one conclusion: it is that there is a real difference, as measured in terms of growth, development and general-health record between optimum and just adequate nutrition; and that every practical effort should be made to apply this knowledge in the interest of human welfare."

IMPROVED NUTRITIONAL STATUS FOLLOWS BETTER FOOD

Observation of persons in institutions or under close supervision where physical status or efficiency has been measured before and after making improvements in the type of food eaten has shown that food can make a difference. This may be measured by various criteria such as growth, work efficiency, freedom from infection, and mental ability. A few examples will suffice. For further details the student is referred to the National Research Council Bulletin 109, reviewed in the preceding section of this chapter, and to original publications.

In a boarding school in England,[3] boys from 6 to 11 years of age were divided into groups and given supplementary foods. The most striking difference was noted between the control group on a good average school diet and the group receiving an extra pint of milk a day. During the first year those in the control group gained on the average 3.85 pounds in weight and 1.84 inches in height, while those receiving the extra milk gained 6.98 pounds and 2.63 inches. Similar gains have been reported in this country as a result of supplementary feeding through school lunches.

A study was also made in England[4] of boys drafted for military service and rejected because of underdevelopment or other defects possibly of nutritional origin. After several months in camp under an optimum nutritional regime, 87 per cent of a group of 834 passed physical examinations in which they had failed before.

The effect of prenatal diet on the welfare of mother and infant is one of the most convincing demonstrations of the past decade of what good nutrition can accomplish. For discussion of these findings and their significance see Chapter 15, "Nutrition During Pregnancy and Lactation."

Improvement in work efficiency has been reported from several industries where good food was provided for workers following less adequate facilities. A well-controlled experiment on a large number of Lockheed aircraft workers in California was conducted by giving a multiple vitamin concentrate to one group and placebos (blanks) to another comparable group. The differences were not striking for the first few months, but by the end of the year the supplemented group showed a reduction of 18.6 per cent in absenteeism and a lower rate of labor turnover than the control group. The over-all gain to production was 4.1 per cent, or 10.5 working days per man per year. Although this experiment was conducted with vitamin concentrates instead of food supplements, the results show that there was room for improvement in the food nutrients ingested.

In contrast with the preceding experiment, work-efficiency tests conducted on men receiving regular army-garrison rations in Minnesota,[5] one group with and one without daily supplements of a multiple vitamin preparation, showed no significant differences. When the ration was already adequate, the supplements gave negative results. The results of these last two experiments should be compared, because in both cases vitamin supplements were used for experimental expediency, but positive results were obtained only with the aircraft workers where there was no control over the food provided and where dietary surveys showed that many of the men were not eating well-chosen diets.

As a last example of what nutrition can accomplish, the work of

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[3] *Ibid.*

[4] Borsook, H.: Milbank Mem. Fund Quart. 23:113, 1945.

[5] Keys, A., and A. F. Henschel: J. Nutrition 23:259, 1942.

Harrell[6] with children in an orphanage shows that improved learning ability can result from dietary supplementation. For one group of children the orphanage diet, which contained about .9 mg. per day of thiamine, was raised to 2.9 mg. by the addition of 2 mg. At the beginning of the study there was no essential difference between Group A (controls) and Group B (supplemented) as to their relative standing in 18 different tests designed to check both mental and physical ability. After 6 weeks the B group receiving thiamine had test scores 27 per cent above the A group on the same series of 18 tests.

POPULAR GUIDES FOR BETTER NUTRITION

For many years nutritionists have offered homemakers easy guides for meal planning. Few people want to be bothered with calculations when buying and preparing food for their families. These dietary patterns differ slightly in their wording or order of items and give essentially the same advice. Several commercial agencies have offered these guides in colorful pictorial form. One of the best known of these is "The Guide to Good Eating," prepared by the National Dairy Council.

The following basic dietary pattern is being adopted by this text for repeated use in discussion of nutrients provided and in the planning of therapeutic diets:

Basic Dietary Pattern for One Day

Milk: 1 pint for adults; 1 quart or more for children

Meat, poultry or fish: 1 or more servings daily

Eggs: 3-5 a week; 1 daily preferred

One other protein food (cheese, nuts, legumes): 1 serving

Fruits, fresh, canned or frozen: 2 or more servings—1 citrus or tomato

Vegetables: 3 servings—1 green or yellow, 1 potato, 1 other

Bread, whole-grain or enriched: Amount depending on need

Cereal, whole-grain or fortified: As desired

Butter or fortified margarine: 2 or more tablespoonfuls

Other food to satisfy appetite and complete growth and activity needs

Such a pattern allows for considerable variation to meet the differences in taste preferences, nationality food patterns and cost. During the war certain modifications were also necessitated by food shortages and rationing, but at no time were people unable to get some types of food from each group.

From this earlier listing of dietary needs was evolved the "Basic Seven" food chart (Fig. 1). This chart was issued in poster and in pamphlet form, and was used extensively by the food industries in advertising. Even though this was first published during the war as a part of the national nutrition program, the information is just as sound today and the 1946 revision shown in Figure 1 is a good device for teaching and checking food habits.

Various nutrition films have also been produced and used for popular education in nutrition. The one entitled "Something You Didn't Eat" by Walt Disney, released in 1945, is a full-color cartoon using the "Basic Seven" theme. Popular talks on nutrition are often more impressive if accompanied by one or two short films, facilities permitting.

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[6] Harrell, R. F.: Teachers College Columbia University Contributions to Education, No. 887, Bureau of Publications, Teachers College Columbia University, New York, 1943.

THE BASIC 7 FOOD GROUPS

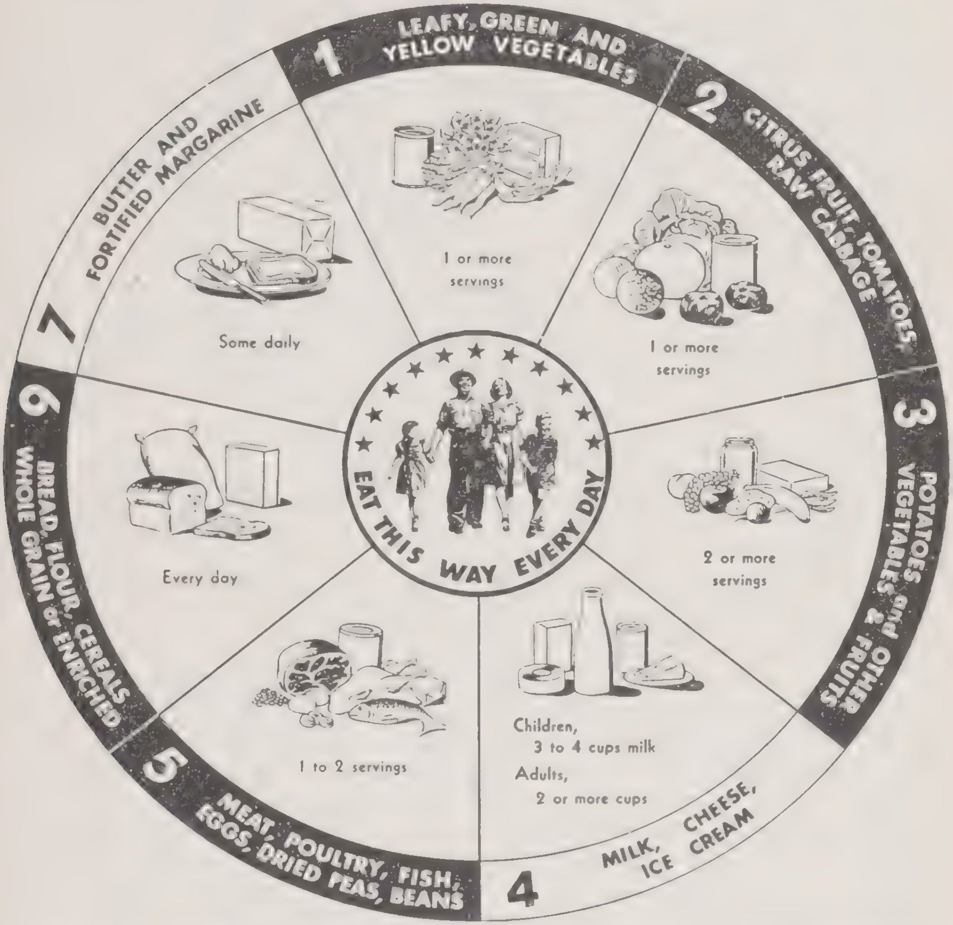
1 LEAFY, GREEN AND YELLOW VEGETABLES
1 or more servings
2 CITRUS FRUIT, TOMATOES, RAW CABBAGE
1 or more servings
3 POTATOES and OTHER VEGETABLES & FRUITS
2 or more servings
4 MILK, CHEESE, ICE CREAM
Children, 3 to 4 cups milk
Adults, 2 or more cups
5 MEAT, POULTRY, FISH, EGGS, DRIED PEAS, BEANS
1 to 2 servings
6 BREAD, FLOUR, CEREALS WHOLE GRAIN or ENRICHED
Every day
7 BUTTER AND FORTIFIED MARGARINE
Some daily
EAT THIS WAY EVERY DAY

Fig. 1. Poster issued by Bureau of Human Nutrition and Home Economics, U. S. Department of Agriculture, Washington.

IMPROVED FOOD CHOICES FOLLOW NUTRITION EDUCATION

It is difficult to evaluate the results of educational programs such as the National Nutrition Program during the war, but sometimes the trends in food consumption over an extended period of time are indicative. A long-time study of the available food supplies in this country made by the United States Department of Agriculture [7] reveals that the nutritional value of the average diet has increased far above the rise in the quantity of food consumed from 1930 to 1945. These data may serve as a measure of achievement in a sense. The charts on page 19 are worthy of careful study to appreciate what has been happening compared with the average for 1935-1939, used as the base line 100.

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[7] Nutritive Value of the Per Capita Food Supply 1909-1945, U. S. Department of Agriculture, Washington, June, 1946.

During the years 1930 to 1945 the energy value of the national food supply remained fairly constant, around 3,300 calories per capita, with a slump during the depression years. In contrast with the calories are the figures for the specific nutrients during the same period. An aroused public interest and a popular educational campaign backed by sound scientific information deserve a good share of the credit for this improvement in food habits.

An increased rate of improvement shown in most of the graphs dates from 1941 or 1942, when the National Nutrition Program was at its peak. The individual curves reflect various other influences. The enrichment program was responsible for the marked upward swing in iron, thiamine, riboflavin and niacin in 1941 and 1942, although the increased use of whole grains had started a rise in these factors even before that. An increased use of citrus fruits and tomatoes dating back some years accounts for the earlier rise in ascorbic acid. More meat, poultry and fish were partially responsible for the rise in protein. Milk and egg consumption has also helped to boost the protein, along with calcium and riboflavin. Vitamin A remained remarkably constant for eleven years and then rose abruptly, beginning in 1941, paralleling the nationwide emphasis on victory gardens and the use of more green and yellow vegetables.

While these results are encouraging, they should not leave us with a feeling of complacency. There is still room for improvement. The income of many people has not risen, while the cost of living has advanced rapidly. Some cannot afford food even as good as they had formerly. Others have been completely indifferent to nutrition education. Therefore, it is apparent that there can be no letup in our efforts to provide everyone with both the money and the knowledge to buy adequate food. It has been estimated that if all families in the country were to consume even moderate-cost food in amounts to afford good nutrition, there would have to be at least one fifth more milk, citrus fruits and tomatoes than were available in 1943 and twice the quantity of green and yellow vegetables.

NUTRITION IN COMMUNITY HEALTH PROGRAMS

Community health programs have always had as a chief objective prevention or prophylaxis against disease, but only recently have public-health officials come to the realization that health education should include nutrition as well as a knowledge of how to prevent the spread of infections; that public-health measures in a community should include attention to the kind of food served in schools, factories, institutions and restaurants, as well as to inspection of the water and the milk supply and the hygiene of food establishments. Education and opportunity for good nutrition are destined to become a major part of every community health program, because it is now generally recognized that optimal health is not possible without the right food and that suboptimal health is frequently responsible for indigence, delinquency, discomfort, inefficiency and potential disease.

To attack new problems in the field of public health is never simple,

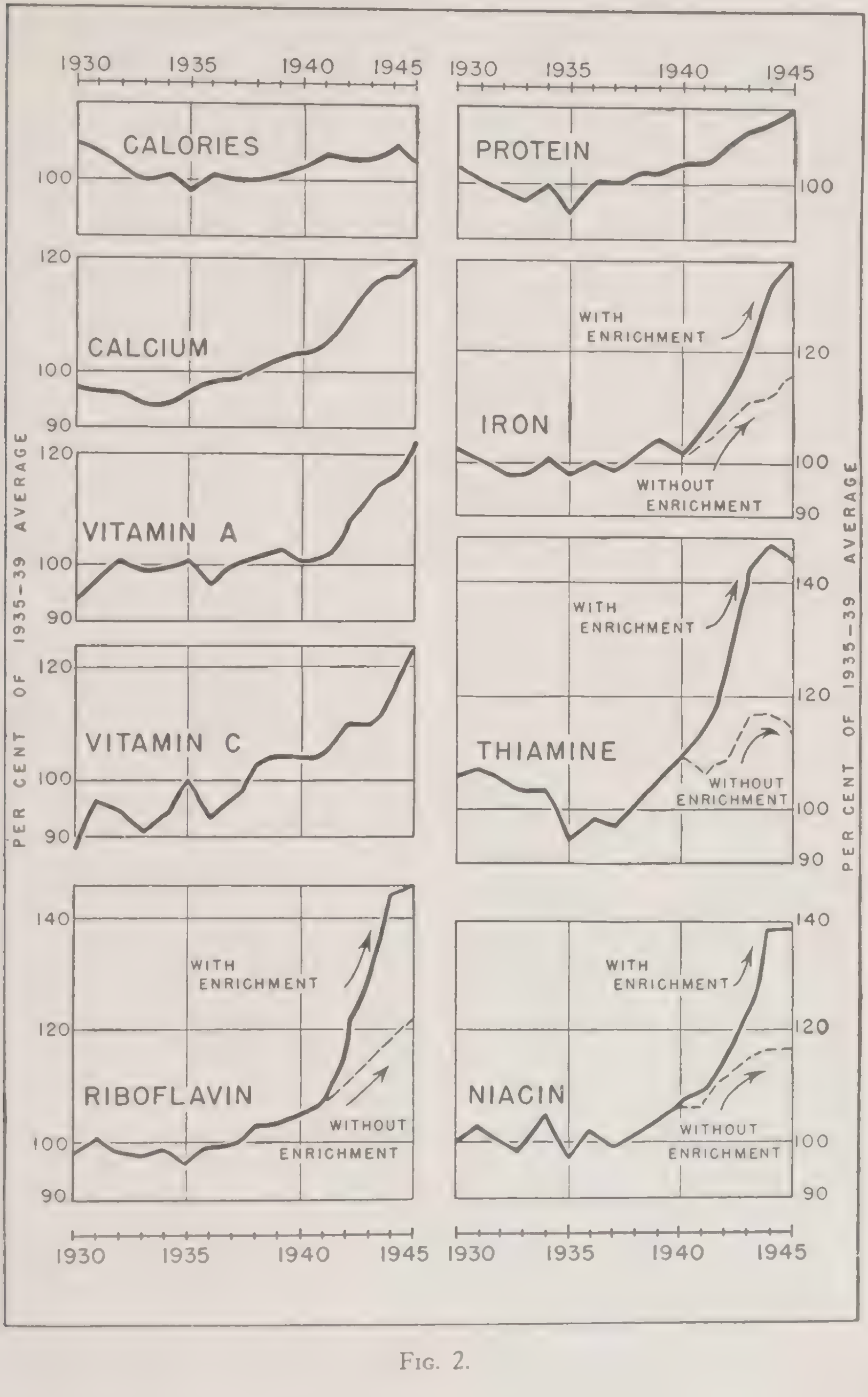
1930
1935
1940
1945
CALORIES
PROTEIN
100
120
CALCIUM
90
IRON
WITH ENRICHMENT
WITHOUT ENRICHMENT
VITAMIN A
THIAMINE
140
VITAMIN C
RIBOFLAVIN
NIACIN
PER CENT OF 1935–39 AVERAGE

Fig. 2.

and that of malnutrition is especially complex, because it has medical, social, economic and psychologic aspects. In any community it requires the co-operation of all public and private agencies with a broad vision on the part of administrators, staff and especially family case workers as to the part that better food can play in improving the health of their clients. Many times they are so concerned with family relations and budget problems that there is little time or inclination to investigate the food used by the family, when this may have a direct bearing on the ability of one or more members of the family to get along with others and make a living.

In recent years a number of health programs in which nursing service is an important factor have been initiated throughout the country These services may be under public or private auspices. Some public organizations, such as state, county and local departments of health and departments of education, may maintain nursing services. Many communities also have a visiting-nurse service under private auspices. The function of a public-health nursing service may be entirely educational, or it may be a combination of health education and bedside care. Checking the food habits of the family or the individual may disclose glaring deficiencies that could be corrected easily within the existing food budget.

The nurse has an opportunity to carry practical nutrition into many homes untouched by other services. She must be prepared to give necessary instruction in regard to food selection, as she will handle few cases in which some improvement is not required. It is strongly recommended that a well-trained nutritionist be included on the staff of the larger organizations to serve as consultant and to plan a broad nutrition program in which public-health nurses may play an important role. In smaller communities where the nursing service cannot afford a full-time nutritionist, assistance and advice may be obtained through consultant services established by the local nutrition committee, by the Red Cross or by other community agencies. Nurition research is advancing at such a rapid pace that the nurse needs the help of a specialist so as to keep in touch with new developments.

The nurse may be of great assistance in helping a patient to carry out the doctor's orders concerning special diets and to fit the diet into the family food plan. In assisting with such a program for one member of the family, improvement in food selection for the family as a whole may incidentally result. Stern[8] in describing the fundamental approach to the education of a clinic patient says: "The fulfillment of the diet plan depends on the successful education of a patient in the principles underlying his diet. These must be presented to him clearly and simply." This also applies to the patient in the home. In many instances poor health that cannot be traced to any organic disease can be corrected by helping the patient to secure an adequate, normal diet.

To change ingrained food habits is usually a slow process and improvements can be made only one at a time. It is a worth-while accomplishment, for instance, to induce a family to purchase an adequate amount of milk, since that in itself makes such a significant contribution to an otherwise poor diet. When money is scarce, it is particularly important to be able to guide families in the selection of foods that will provide adequate nutrition for all members at low cost. Instruction may be needed in the preparation of food, and these suggestions should be made in the light of the facilities available for cooking.

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[8] Stern, F.: Applied Dietetics, Baltimore Williams & Wilkins, 1943.

In certain circumstances the nurse may have a unique opportunity to promote better nutrition. She may be expected to make practical suggestions for securing the kind and the amount of food necessary during pregnancy and lactation (see Chap. 15). She may be called upon to help in preparation of the baby's formula and, later, to advise on the introduction of foods other than milk (see Chap. 16). Preschool and older children may need guidance in food habits, or the mother may have to be helped as to what foods to buy, how to prepare them and how to induce the children to eat the right food. When the children reach high-school age and begin to eat one meal away from home, good food habits established early count, but even then they may need guidance on how to choose the best lunch for the limited amount that they have to spend (see Chap. 17). Adults and older people often fail to realize that their health also may depend upon the habitual consumption of an adequate diet and that good food habits can delay the progress of senility in older people (see Chap. 18). During convalescence, when the period of acute illness is passed, the public-health nurse can be of great assistance in suggesting foods that will hasten recovery and help the patient to adjust to a normal diet again.

REVIEW QUESTIONS

1. Discuss the prevalence of malnutrition in the United States. How have the data on this subject been obtained?

2. What is the difference between information derived from dietary surveys and that obtained from nutritional-status studies, and how can each be used to advantage in nutrition education?

3. Numerous popular guides have been published to help laymen select better food. Which of these guides with which you are familiar have been helpful to you?

4. Have you obtained convincing evidence from this chapter or from other reading or experience that improved nutrition pays dividends? Cite instances that you consider most convincing.

5. Health departments have long been responsible for prevention of communicable diseases. How will the addition of nutrition education alter the programs of health agencies? With which groups is nutrition education most effective?

3

Carbohydrates

Chapter Topics

- SUGARS
  - MONOSACCHARIDES OR SINGLE SUGARS
  - DISACCHARIDES OR DOUBLE SUGARS
- POLYSACCHARIDES
  - STARCH, GLYCOGEN AND DEXTRINS
- POLYSACCHARIDES (CONT.)
  - CELLULOSE AND HEMICELLULOSE
- CARBOHYDRATE FOODS IN HUMAN NUTRITION
- METABOLISM OF CARBOHYDRATES

The carbohydrates are so called because they are composed of carbon, hydrogen and oxygen, these last two elements being always present in the proportion found in water. These three elements—carbon, hydrogen and oxygen—in the form of carbohydrates make up the great bulk of all vegetable foods. They are the plant world's store of potential energy synthesized by the action of sunlight and chlorophyll from the water in the soil and the carbon dioxide of the air. (See Figure 5, page 28, diagram of the synthesis of carbohydrates in plants.) Except for lactose in milk and glycogen in liver, they are present only in traces in animal foods.

SUGARS

Monosaccharides or Single Sugars

Monosaccharides or single sugars are those that cannot be further split and yet remain a sugar, while the disaccharides or double sugars may be split into two single sugars. There are three common single sugars: dextrose (grape sugar or glucose), levulose (fructose or fruit sugar) and galactose. They are all readily soluble, and although there is thought to be some action upon them before they are absorbed, the tax on the digestive powers is slight. These single sugars are not as sweet as the disaccharide sucrose; dextrose, for example, is only two fifths as sweet.

Dextrose occurs in fruits, being particularly abundant in grapes. When these are dried to make raisins the dextrose can be seen in the form of little yellowish-white grains. Other fruits, most vegetables and honey contain some dextrose. Commercial glucose or dextrose, which is used in the manufacture of candies and sirups, is made by boiling starch or other carbohydrates with acids. The blood of all animals contains glucose in small amounts.

Levulose, also known as fructose, is found in most fruits, in many vegetables, and in honey, in which it usually occurs in almost equal quantity with glucose.

Galactose is not found free in nature, but results from the digestion of milk sugar or lactose.

DISACCHARIDES OR DOUBLE SUGARS

The principal disaccharides are maltose, sucrose and lactose. Lactose is found in the milk of mammals, sucrose in the juices of many fruits and vegetables. Maltose may be found in plant tissue (barley) and it is one of the products formed in the digestive tract in the digestion of starches.

Maltose is commercially prepared from starch in the malting process in the manufacture of beer through the action of diastase, a plant enzyme. The ptyalin of the saliva and the amylase of the pancreatic juice have a similar chemical action. Maltose is the chief end product of the digestion of starch by saliva. This salivary action may be compared to commercial malting, and also to the sprouting of seeds in the ground. When a seed, such as barley or wheat, is planted, the moisture of the soil from rains and the heat from the sunlight activate the diastase, causing some of the stored starch of the grain to change into sugar; that is, to be "digested" to sugar. When grain is put into a vat of warm water instead of planted in the soil, the same thing happens. When the digestive process—the action of the diastase on the starch—has proceeded to a sufficient degree and enough sugar has been produced, the "water" is drained off and evaporated until a thick, sirupy solution is obtained.

Maltose is digested in the intestine by the enzyme maltase, and each molecule of maltose yields two molecules of glucose.

Lactose, or milk sugar, is much less sweet to the taste and is less easily fermented than other sugars. When fed in large quantities some of it tends to pass along the intestinal tract unabsorbed, reaching the colon and there forming a good medium for the growth of the acid-forming bacteria, often considered beneficial in combating putrefaction. That which is digested in the small intestine by the enzyme lactase yields one molecule each of glucose and galactose.

Sucrose is found in fruits and in the juices of many plants. Its most common sources are the sugar cane and the sugar beet, from which it is made into the commercial sugars used in the household. After refining, cane sugar and beet sugar are practically indistinguishable. Another source is the sap of the sugar maple.

Sucrose, from whatever source, is readily digested in the small intestine by the action of the enzyme sucrase, yielding one molecule each of dextrose (glucose) and levulose (fructose).

Invert sugar is a mixture of equal parts of dextrose and levulose. It is 30 per cent sweeter than the sucrose from which it is derived. The dextrose is somewhat less sweet, but the levulose is much sweeter, making a net gain in the mixture of the two single sugars. Invert sugar may be formed from sucrose by the action of acids or enzymes found in the intestinal juice. In making jams, invert sugar is often formed by the action of the fruit acid on the cane sugar used in cooking. This procedure was recommended during the wartime sugar shortage. Invert sugar is found in many fruits and also in honey.

Unrefined or natural sugars are sometimes used without purification and recrystallization. "Raw sugar" is a result of the first crystallization process. Molasses is an unpurified byproduct of sugar manufacture. All such products contain some of the minerals and the vitamins of the natural product in more or less concentrated form.

The normal sugar content of the blood is approximately one part sugar to a thousand parts blood. If, through excessive eating of sugars, this proportion is exceeded, the tissues must store or excrete the excess sugar. In disease, as well as when normal consumption has been greatly exceeded, the kidneys remove and excrete the excess as glucose in the urine. The liver and, to a limited extent, the muscles also are capable of changing excess sugar to glycogen or animal starch and storing it for further use. When needed, it may be changed back to the monosaccharide glucose, to be utilized by the tissues. The liver apparently acts as a regulator for the amount of sugar passing into the blood stream, and the pancreas largely controls its utilization. Most of the sugar in the blood undergoes combustion to yield energy and the end products are carbon dioxide (CO_2) and water (H_2O).

Sugars in excess of the limited amounts that may be stored as glycogen are converted into fat and deposited as adipose tissue, or they are excreted from the body as glucose in the urine. The rate of synthesis of fat from carbohydrate varies with the individual.

POLYSACCHARIDES

Starch, Glycogen and Dextrins

These carbohydrates are more stable, although less soluble than sugars. Nature seems to prefer to store foodstuffs in such a way as to prevent loss and deterioration. Because of the large amounts of moisture always present in growing plants, one of the first essentials in the storage material is insolubility. This apparently is the reason why so much of the carbohydrate is stored as starch.

In such fruits as the banana the carbohydrate is in the form of starch while the fruit is maturing, but some of it is changed into sugar as the fruit ripens. In most vegetables the sugar made by the leaves is stored as starch, as in peas, beans and corn. Except for glycogen, all food polysaccharides are products of plant growth.

Starch Structure. A starch grain or granule consists of tiny particles of starch usually arranged in more or less concentric layers, with an encasing membrane often composed in great part of cellulose. Each kind of starch—potato, wheat, or any other kind—has its own characteristic shape and appearance, so that a microscopic examination reveals the source.

Starch Digestion. Before starch can be used by the body, the outer membrane must be broken, e.g., by grinding or cooking. It must then be changed to a more soluble form, and this process takes place most rapidly by the application of heat and moisture. While recent experiments have shown that under certain conditions the body is capable of digesting and absorbing relatively large quantities of raw starch, in the light of present knowledge this must be regarded more as testimony to the adaptability and the efficiency of the human machine than as an argument in favor of the ingestion of raw starch.

Starch is insoluble in cold water, but when it is heated in the presence of water the outer cellulose envelope is ruptured and the moisture permeates to the starch granules themselves. The true starch, found within the cellulose covering of the granule, has a great affinity for water, absorbing it as a sponge does. When used for thickening, such pulverized raw starches as cornstarch and flour should be mixed with cold water and stirred to a smooth paste before they are added to a hot liquid.

After the rupture of the cellulose walls by cooking, starch, when taken as food, is acted upon by the ptyalin of the saliva. In salivary digestion starch passes through several stages: it is first transformed into soluble starch as described above; then into a series of three or more intermediate products known as dextrins; and later into the sugar maltose, an entirely soluble product. Accompanying each dextrin stage a small quantity of maltose is formed, the amount increasing gradually with each step in the process of salivary digestion. It is common knowledge that a piece of plain cracker or bread becomes sweet to the taste if chewed long enough; that is, if it is retained in the mouth a sufficient length of time to permit digestion to proceed to the maltose stage.

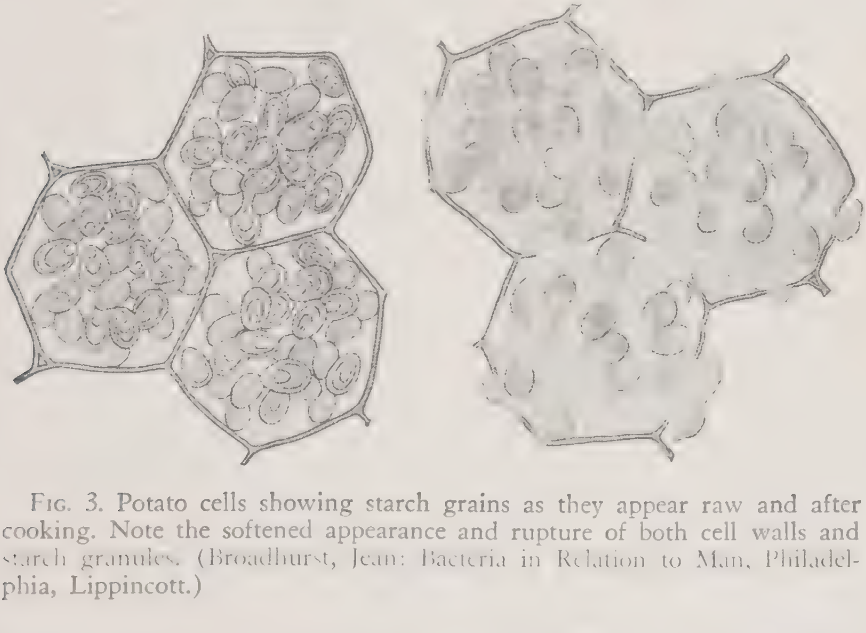

Fig. 3. Potato cells showing starch grains as they appear raw and after cooking. Note the softened appearance and rupture of both cell walls and starch granules. (Broadhurst, Jean: Bacteria in Relation to Man, Philadelphia, Lippincott.)

Effects of Cooking. In cooking, starch may be carried through the first of these digestive stages by the application of heat and moisture over rather long periods of time. While starch granules are broken down most rapidly when moisture is present, long application of dry heat (about 300° F.) will render the starch soluble and ultimately change it into a dextrin, giving, for example, the brown color characteristic of the crust formed on a loaf of bread in baking.

The length of time starches are cooked apparently affects the rate more than the completeness of digestion. The ptyalin of saliva does not act upon raw starch. Since much of the digestion of cooked starch takes place through salivary activity, even after the food reaches the stomach, the need for thorough mastication of such foodstuffs is apparent. In the intestines the digestion and the absorption of the remaining starch go on as has been described in the first part of this chapter. Starch, as is shown there, must be transformed into a sugar before it can be utilized by the body. Dextrins are found to some extent free in nature, especially in cereals, but they occur more frequently as an intermediate product in the conversion of starch into maltose. They are more soluble than the starches.

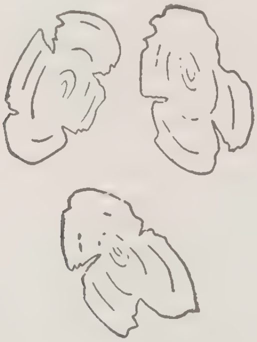

Fig. 4. Potato starch grains showing partial digestion by saliva. Whole grains shown in Fig. 3. (Broadhurst, Jean: Bacteria in Relation to Man, Philadelphia, Lippincott.)

Cellulose and Hemicellulose

These two types of carbohydrate, frequently classed together as fiber, are polysaccharides of a more insoluble type than starch.

The bran of wheat and the outer covering of other grains are good examples of cellulose found in common food. Nearly all indigestible plant fiber is cellulose, wood being the most striking example.

The hemicelluloses are closely related to cellulose, but of slightly different chemical structure and properties. They have the power of absorbing many times their volume of water and form jells of varying consistency. Pectin, the jelling constituent of fruits, and agar-agar from seaweed are the best-known types of hemicellulose used for food.

The values of cellulose and hemicellulose in digestion are discussed in Chapter 9. A small fraction may be broken down by bacterial enzymes, but the alimentary enzymes cannot digest cellulose to any extent.

CARBOHYDRATE FOODS IN HUMAN NUTRITION

The average American obtains from 60 to 70 per cent of his calories from carbohydrate, more from starch than from sugar. In fact, foods high in starch are the major sources of calories for most of the peoples of the world. Cereal grains and potatoes are the cheapest and the most easily produced foods. Some form of starch makes up over 80 per cent of the caloric value of these foods.

The importance of grains and potatoes in world food economy has been emphasized especially in recent years. Wheat is a mainstay the world round in a variety of forms, chiefly bread. Rice is the major grain food in parts of the Orient, and corn, rye, oats, barley and millet in various areas are all-important sources of starch. In fact, for peoples in the temperate zone the higher the percentage of the total calories drawn from grain and potatoes the lower the standard of living in general.

Sugars are less widely distributed than starches and are usually regarded more as luxury foods. The consumption of sugar is determined more by tradition and food habits than by economic status, although the consumption is apt to be low in countries where the economic level is low. The per-capita consumption of sugar in the United States is high compared with that of most other countries, ranging in the neighborhood of 100 pounds per year in prewar years. The reduction in sugar consumption due to rationing is in line with better food habits. Ordinary table sugar is cheap in terms of calories but "calories in poor company," i.e., no protein, minerals or vitamins. Thus, nutritionally, sugars and sirups should be considered as seasonings rather than as major sources of calories.

Sugar in great concentration is irritating to the mucous lining of the stomach. Brandl,[1] in experiments on dogs, showed that a 5.7 per cent solution of sugar produced a reddening of the mucous membrane, that a 10 per cent solution caused the mucous membrane to become dark red, and that a 20 per cent solution produced pain and distress.

Sucrose in concentrated form (table sugar or candy, for instance) should always be eaten in such form or under such conditions that it will be diluted when it reaches the stomach. Taken on an empty stomach, as candy or otherwise, it impairs the appetite and thus discourages the taking of a sufficient supply of foods that are more desirable because they are richer in minerals, vitamins and other essentials. Candy and similar very sweet foods should be eaten in moderation and, preferably, with or just after meals, so as to protect the mucous membrane of the stomach from the irritating action of too much sucrose. Mixed with other foodstuffs in the stomach, the sugar naturally becomes much diluted. Here, again, is an excellent example of the wise provisions of nature regarding food. As found in the natural state, sugar occurs in rather dilute forms. In sugar cane the proportion of sucrose is only 18 per cent; in the sugar beet, about 15 per cent. If human beings would confine their intake of these sugars to forms as dilute as those found in the natural foodstuffs, probably no harm would result from them. The use of sweet fruits as a substitute for candy and sweetmeats of all sorts is a practice to be highly recommended, for adults as well as for children. The fruits not only supply all the sugar needed, in a form easily used by the body, but furnish mineral salts, vitamins and cellulose. Raisins, figs, dates and prunes are particularly useful as sweetmeats.

Fruits contain most of their available calories in the form of sugars but diluted by water and fiber and accompanied by minerals and vitamins. Thus they are considered far better foods nutritionally than pure sugars, even though their sugar content is responsible for their caloric value. Fruits are sometimes considered luxury foods. To be sure, they are expensive sources of calories. The nutritive value of fruits is usually rated according to their mineral and vitamin content. They are relished for flavor and texture, and either fresh or dry are more desirable than candy for between-meal snacks.

METABOLISM OF CARBOHYDRATES

The carbohydrates, the starches and the sugars are used in the body as quickly available sources of heat and energy. The elements in the composition of carbohydrate all contribute to making it an efficient fuel food. Hydrogen, a great heat producer, is used for welding and for supplying an intense heat when desired at other times. Carbon is a constituent of all fuels—gasoline, alcohol, charcoal, wood and coal. Oxygen is the element that supports combustion. However, the oxidation of carbon and hydrogen in the body is not a simple combustion process.

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[1] Reported by Hutchison, Robert: Food and the Principles of Dietetics, New York, Wood, 1922.

The varied forms of carbohydrate that occur in foods must all be reduced to one form before they can be utilized by the tissues. That is the purpose of digestion and the changes that take place in the liver. All digestible carbohydrate is reduced to single sugars in the alimentary tract (see Chap. 10). After the three single sugars have been carried to the liver by the portal circulation, the enzymes there change most of the sugar to liver glycogen and release only a little glucose at a time to circulate in the blood. The level of blood glucose rises slightly after meals in normal persons, but is maintained at a relatively constant level, from 80 to 120 mg. per 100 cc. of blood.

The circulating blood glucose is absorbed by the muscles and other tissue cells to maintain their normal reserve, mostly in the form of glycogen synthesized by the cellular enzymes. The muscle glycogen is the reserve fuel for muscular energy and forms a complex glycogen-phosphorus compound that can break down with almost explosive speed when the nerve impulse demands muscular action. Much research has been undertaken in an attempt to discover the exact nature of this chemical reaction, which creates motion in a manner utterly unlike anything that occurs outside the body. Three vitamins of

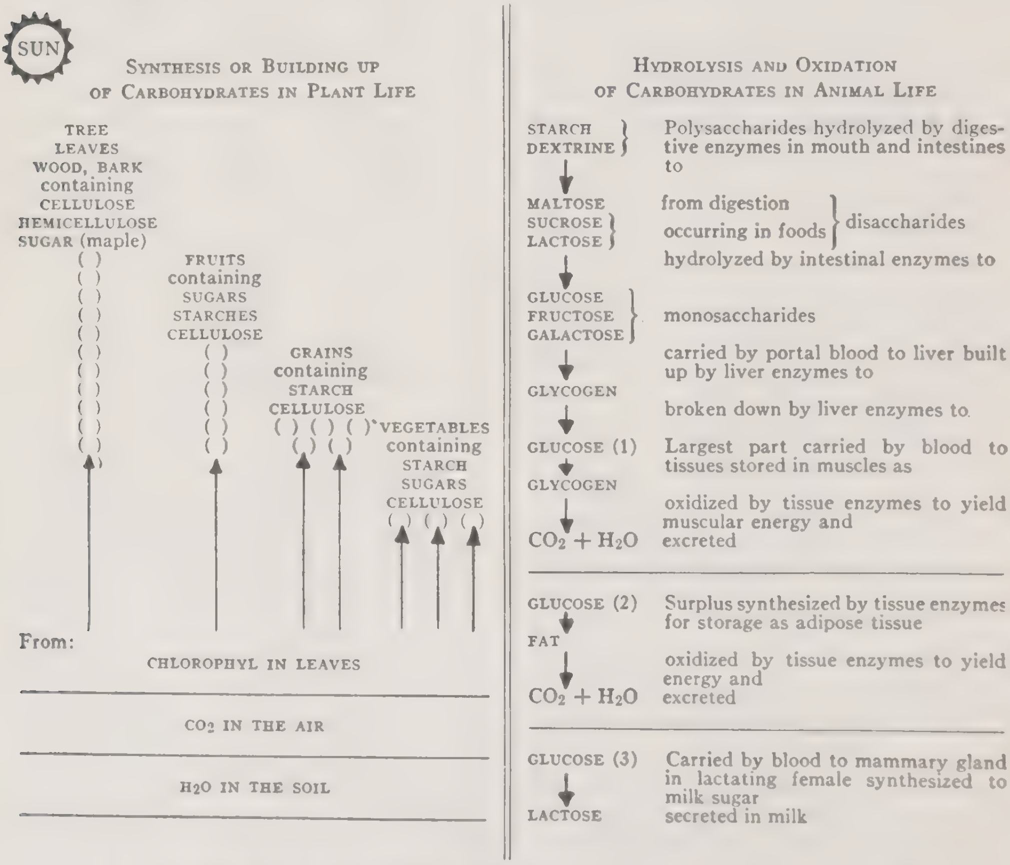
SUN
SYNTHESIS OR BUILDING UP OF CARBOHYDRATES IN PLANT LIFE
TREE LEAVES WOOD, BARK containing CELLULOSE HEMICELLULOSE SUGAR (maple)
FRUITS containing SUGARS STARCHES CELLULOSE
GRAINS containing STARCH CELLULOSE
VEGETABLES containing STARCH SUGARS CELLULOSE
From:
CHLOROPHYL IN LEAVES
CO_2 IN THE AIR
H_2O IN THE SOIL
HYDROLYSIS AND OXIDATION OF CARBOHYDRATES IN ANIMAL LIFE
STARCH
DEXTRINE
Polysaccharides hydrolyzed by digestive enzymes in mouth and intestines to
MALTOSE
SUCROSE
LACTOSE
from digestion
occurring in foods
disaccharides
hydrolyzed by intestinal enzymes to
GLUCOSE
FRUCTOSE
GALACTOSE
monosaccharides
carried by portal blood to liver built up by liver enzymes to
GLYCOGEN
broken down by liver enzymes to
GLUCOSE (1)
Largest part carried by blood to tissues stored in muscles as
GLYCOGEN
oxidized by tissue enzymes to yield muscular energy and
$CO_2 + H_2O$
excreted
GLUCOSE (2)
Surplus synthesized by tissue enzymes for storage as adipose tissue
FAT
oxidized by tissue enzymes to yield energy and
$CO_2 + H_2O$
excreted
GLUCOSE (3)
Carried by blood to mammary gland in lactating female synthesized to milk sugar
LACTOSE
secreted in milk

FIG. 5. Synthesis and breakdown of carbohydrates in plant and animal life

the B complex group are involved in the oxidation-reduction reactions of carbohydrates in muscle tissue. Muscular work is often compared to a mechanical engine, but all such comparisons fail to emphasize the fact that heat is more a by-product of this reaction in the body than a means of producing it, as in an engine. To be sure, the heat that is produced is used to maintain body temperature.

When more carbohydrate than the body needs for daily work is eaten, the extra is stored for future use. Glycogen in the liver and the muscles is the temporary storage to carry from meal to meal and overnight. It would be nearly all used up in a day or two if food were not eaten. The real surplus carbohydrate is transformed into fat and stored as adipose tissue. A certain amount of body fat is necessary for warmth, for protection from shocks and for holding organs in place, but a surplus of body fat is a handicap and a hazard to health. An overliberal supply of carbohydrate in the diet continually is the chief cause of obesity.

Some carbohydrate is essential for the normal metabolism of other foodstuffs. Fatty acids do not oxidize as readily as sugars in the body. When the body is called upon to burn fat in the absence of carbohydrate, a condition known as acidosis is apt to occur, because the products of the incomplete oxidation of fatty acids are acid in reaction and are toxic to the body.

The glucose in the blood stream is used for still another purpose in the lactating female. When the mammary glands are active, glucose is synthesized by enzyme action in these glands to form milk sugar—lactose. This occurs nowhere else in nature.

REVIEW QUESTIONS

1. Carbohydrates are so called because they are made up of carbon, hydrogen and oxygen. In what proportion are the hydrogen and the oxygen present? What are the end products of combustion of sugars?

2. Sugars are classified as monosaccharides and disaccharides. Name the monosaccharides that result from the digestion of each disaccharide.

3. The normal sugar content of the blood is 1 to 1,000 (0.1 per cent). In what form is this sugar present, and what controls the amount? How is the excess stored?

4. There are several common polysaccharides. Which can be digested easily, and where? In which foods are the indigestible ones found?

5. Trace the breakdown of starch in the body from the time it is eaten until all end products have been formed and disposed of.

6. A few foods such as pure cane sugar contain 100 per cent carbohydrate. However, most foods contain some of each of the other major food constituents. In the following tabular form list ten foods rich in starch and ten foods rich in sugar and give their complete percentage composition as indicated. (See Table 1, Part Four.)

Food	Protein	Fat	Carbohydrate	Calories

4

Fats and Related Substances

Chapter Topics

FATS AND OILS	DIGESTION AND ABSORPTION
RELATED SUBSTANCES	METABOLISM AND STORAGE
IMPORTANCE OF FAT IN THE DIET	SOURCES OF FATS AND OTHER LIPIDS

FATS AND OILS

Fats belong to a group of chemical substances known as lipids, greasy to touch and insoluble in water. Chemically true fats are called triglycerides and are made up of three molecules of fatty acids and one molecule of glycerol. Fats resemble the carbohydrates in composition in that they are made up of carbon, hydrogen and oxygen. However, they differ from carbohydrates in the proportion in which these three chemical elements occur, the fats containing less oxygen and more carbon and hydrogen than the carbohydrates or proteins. Fats are concentrated foods, and when burned produce approximately two and one fourth times as much heat as do the carbohydrates or the proteins.

There are a number of fatty acids that in various combinations give to fats their specific characteristics. As a result of these combinations there are fats of varying degrees of hardness; for example, the oils, which are liquid, and beef and mutton fats, which are solid. The fat of cold-blooded animals—fish, for example—is a softer fat and remains plastic at the low temperature to which it is exposed, while that of the warm-blooded animals has a higher melting point and is consequently harder at room temperature. As a rule, the fat of herbivorous animals is harder than that of carnivorous animals. A large part of our supply of fat for cookery is obtained from the former. When the adipose tissue of animals is subjected to heat, the fat liquefies and thus separates from the connective tissue cells in which it is deposited.

RELATED SUBSTANCES

In addition to fats, the phospholipids and the sterols play very important roles in metabolism. The phospholipids are compounds consisting of a fat to which is attached a phosphoric-acid radical and a nitrogen-containing base. Two of the most important of this group are lecithin and cephalin, both important cellular constituents. Bloor[1] states that the phosphoric acid of these compounds is now known to "take part in most of the stages of carbohydrate metabolism."

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[1] Bloor, W. R.: J.A.M.A. **119**:1018, 1942

Lecithin undoubtedly plays an important part in fat metabolism, but just how and to what extent have not been determined. Choline, a part of the lecithin molecule, is now known to be essential to the prevention of fat accumulation in the liver, a condition known as "fatty liver disease." The phospholipids occur in relatively large amounts in the brain, the liver, the heart, the kidney, the lungs and, to a lesser extent, in all voluntary muscles. Egg yolks are also a rich source.

The sterols are compounds of alcohols with fatty acids and are soluble in fat solvents. Among the most important sterols are cholesterol and ergosterol. Cholesterol is found in all body tissues, especially in the brain and the nerve tissue, the suprarenal gland, the liver and the blood. It is also a constituent of bile and often appears as a morbid product in gallstones and in the kidney. It accumulates in the blood plasma in nephrosis and in diabetes mellitus. The richest food source of cholesterol is egg yolk.

Closely related to cholesterol is ergosterol, both of which are precursors of, and may be converted into, vitamin D by means of irradiation with ultraviolet light (see chapter on Vitamins). The pure sterols if dissolved in oil or foods, such as milk, may thus be activated by irradiation. Ergosterol is of plant origin, while cholesterol is from animal sources only. When irradiated, ergosterol becomes calciferol, which, when dissolved in oil, is a concentrated source of vitamin D. Commercially, irradiated ergosterol in oil is known as viosterol.

There are three fatty acids now recognized as "essential." That is, either they are not synthesized or are not synthesized rapidly enough in the body to meet its needs, and must, therefore, be consumed as constituents of food. They are arachidonic, linoleic and linolenic, the last two being so named because they were first discovered in linseed oil, although they are now known to be constituents of most of the food oils, as well as of egg yolk, butter and the organs and the tissues of animals. The human requirement for these essential fatty acids is apparently small and is ordinarily met easily in the average diet.

IMPORTANCE OF FAT IN THE DIET

Fats play a very important part in the diet. They give flavor to it and seem to act as regulators of the emptying time of the stomach. During both world wars fats were in short supply. Food low in fat has poor satiety value because the stomach empties too rapidly. Even in the United States, where the total consumption of fat was not drastically reduced, the average consumer was aware of the change. This was probably due to the fact that the reduction of "visible" fats, i.e., fats purchased as such, was greater than the reduction of "invisible" fats, i.e., fats in natural foods. The human body can make use of either form of fat and can adjust to a reduction in total fat intake without apparent physiologic strain. Food habits vary widely as to per-capita fat consumption, yet a drop below the usual level is a cause for discontent. Hence it is easy to understand the morale value of fat to people who have been subsisting for years on starchy vegetables with little meat or other fats.

DIGESTION AND ABSORPTION

Some digestion of fat may occur in the stomach through the action of the gastric lipase, but most of it occurs in the small intestine through the action of steapsin, the pancreatic lipase, and the bile (see Chap. 10). By action of this pancreatic lipase the fats and other lipids are broken down into their component parts, the fatty acids and glycerol, their alcohol radical. These products are then absorbed and in the passage through the intestinal wall they are built up into phospholipids or neutral fats before they pass on into the lymph vessels and eventually into the blood stream. It is probable that there is a mixing of fatty acids from various sources—some from other food fats, some from the endogenous fat and some synthesized from other foods. Following absorption, the fats are transported via the thoracic duct to the left shoulder, where the lymph flows slowly into the blood stream in the left subclavian vein. The blood then carries the fat compounds to liver and tissues. •

The digestibility of fats varies to some extent; the softer fats—those with the lower melting point—are more completely digested by man than those with the higher melting point. Butterfat, with a melting point of 32° C., is digested with a loss of only 3 per cent; beef fat, with a melting point of 45°, with a loss of 7 per cent; but with mutton fat, having a melting point of 50°, there is a loss of 12 per cent in digestion.

Foods which are surrounded by coatings of fat, especially if the food is saturated to any extent, as in the case of some fried foods, are often much delayed in their passage through the stomach. Cooking of the fats at high temperatures sometimes reached in frying brings about changes which make digestion more difficult. The glycerol of the fat may break down into irritating substances and some changes may also occur in the fatty acids when subjected to high temperatures. For these reasons, and because they may introduce an excess of fat, fried foods are usually withheld from sickroom dietaries. Even for normal persons fried foods should be used sparingly, and the temperature of the fat used in frying should be carefully controlled.

METABOLISM AND STORAGE

Interchange of Fats and Carbohydrates. Fats and carbohydrates are, to a certain extent, interchangeable as a source of energy. Both yield energy in the form of work and heat when oxidized by the tissues and the liver. However, their oxidation proceeds along different lines. The utilization of carbohydrates was described in the previous chapter. Fats are split into their component parts—fatty acids and glycerol. Glycerol is changed to glucose and oxidized as such, yielding about one twentieth of the total calories of the fat. Fatty acids have a greater concentration of carbon and therefore yield more energy. The oxidation of the fatty acids proceeds by processes that are complicated and little understood to yield eventually CO_2 and H_2O. In certain diseases complicated by acidosis the intermediate products of this oxidation, namely, aceto-acetic acid, beta-oxybutyric acid and acetone, may become the abnormal end products. They appear in the blood stream and to some extent are excreted in the urine. The volatile member of the group—acetone—may give a characteristic odor to the breath. The chemical structure of two of these compounds classifies them as ketones and has given rise to the term ketosis as one type of acidosis. These three so-called acetone bodies are found in severe cases of diabetes, also in starvation when the body is burning its own fat (see Chap. 23).

The fat not needed for immediate use is stored in the body depots as adipose tissue to be drawn upon in any emergency. Body fat may be formed from carbohydrates (see Chap. 3) and to a lesser extent from the proteins. This storage of fat is valuable in assisting in the regulation of the body temperature, as the layer of fat beneath the skin acts as a nonconductor and prevents excessive radiation or loss of body heat. It also serves to protect the body from mechanical injury and acts as a support to vital organs, particularly the kidneys. Too great a deposit, on the contrary, may put an unnecessary burden upon the heart and other organs.

SOURCES OF FATS AND OTHER LIPIDS

Among the most valuable fats from animal sources are those from milk, cream, butter and egg yolks. The tissues of all animals contain some fats, and many carcasses yield large amounts, especially pork and beef. The livers of fish and animals are rich sources of fats and other lipids, including the "essential" fatty acids.

Numerous vegetable oils, such as olive, peanut, cottonseed, coconut, soybean and corn, are extracted by pressing. Most of the well-known cooking fats other than lard are made from less expensive vegetable oils by hydrogenation. This chemical process involves introduction of hydrogen into the fat molecule under carefully controlled conditions to produce a fat with just the right melting point for most culinary purposes.

Margarine is processed largely from vegetable fats or oils which are churned in cultured milk to give the flavor of butter. When fortified sufficiently with vitamin A to bring its content up to the average of butter, it becomes a good substitute for butter. Sources of vegetable fats are nuts, seeds, chocolate and avocados.

Mineral oil, known also as paraffin oil, is not a true fat and is neither digested nor absorbed by the body. It was formerly used in place of true fats in certain special low-calorie diets. This procedure should be discouraged because mineral oil tends to interfere with the absorption of all the fat-soluble vitamins. It is particularly detrimental when used in a food such as salad dressing or when taken with meals.

REVIEW QUESTIONS

1. Fats resemble the carbohydrates in composition but are more concentrated foods. How does the difference in composition account for the difference in fuel value?

2. Fats are compounds formed from glycerol and fatty acids. Which of these components is responsible for the different characteristics of natural fats? How does the melting point of fats vary with species and function in the body?

3. The cooking of fats at high temperatures results in undesirable chemical changes. How does fat or its high-temperature breakdown products affect digestion?

4. To what extent are fats and carbohydrates interchangeable in their utilization by the body? Which are more easily burned? What are the normal end products in both cases and which may yield abnormal end products?

5. Certain fatty acids and related substances are essential to proper func-

tioning of the body. Name these substances. What is meant by the term essential?

6. There are numerous pure fats and oils manufactured from animal and vegetable sources, but most of our natural foods contain appreciable amounts of other food constituents associated with fats. Give the percentage composition of ten foods relatively rich in fats. (See Table 1, Part Four.)

5

Proteins

Chapter Topics

- CHEMICAL NATURE AND SYNTHESIS
- AMINO ACIDS
- QUALITY OF PROTEINS
- PROTEIN METABOLISM
- PROTEIN REQUIREMENTS
- FOOD SOURCES OF PROTEIN

Proteins have long been recognized as fundamental building material of every cell of the body. Proteins or protein derivatives are also constituents of the body fluids, functioning chiefly as regulators, which function is fully as important as that of structural elements. Thus protein well deserves its name, which is of Greek derivation, meaning "of first importance." Since proteins are the principal constituents of the active tissues of the body, and since the body is dependent upon food protein for these indispensable substances, the quality and the quantity in the daily diet are of prime importance.

CHEMICAL NATURE AND SYNTHESIS

Proteins, as well as fats and carbohydrates, are composed of carbon, hydrogen and oxygen, but in addition they contain nitrogen, usually sulfur and sometimes phosphorus and iron. Chemically pure proteins are fairly stable, but in a moist state in which they are generally found in foods they decompose readily at room temperature. This spoilage is due to bacterial action and may form substances toxic to the body. In this respect, nitrogenous foods are more unstable and will decompose more readily than carbohydrates and fats. Protein foods such as fresh meat, fish and eggs, therefore, should be kept in the refrigerator to prevent or delay decomposition.

In the plant kingdom protein occurs less abundantly than carbohydrate and fat, yet it is an important constituent. It is the plant which supplies the original source of animal protein. Green plants build or synthesize proteins from inorganic materials such as water, carbon dioxide and nitrogen salts, which they obtain from the air and the soil. Animals build up their protein from plants or from other animals which use plants for their food.

AMINO ACIDS

Proteins are made up of nitrogen-containing compounds known as amino acids, held together in a chain-like chemical structure. Proteins are among the most complex organic compounds found in nature and have molecular weights ranging from 35,000 to several million.

The first one of the amino acids was discovered over 125 years ago, but the last of the 22 known today was isolated and identified in 1935 by W. C. Rose. During the century between these discoveries much of the basic chemistry and physiologic significance of proteins came to be understood. With the realization that amino acids were important factors in determining the value of proteins, many investigations were conducted to find out which of these amino acids were indispensable and which could safely be excluded from the diet without interfering with normal growth and body function. Most of the fundamental research was done with experimental animals, the pioneer work by Osborne and Mendel, and much of the later work by Rose, a former student of Mendel.

According to Rose,[1] there are ten essential and twelve nonessential amino acids for growth of rats used as experimental subjects. These are as follows:

CLASSIFICATION OF AMINO ACIDS WITH RESPECT TO THEIR GROWTH EFFECTS IN EXPERIMENTAL ANIMALS

Essential	*Nonessential*
Lysine	Glycine
Tryptophan	Alanine
Histidine	Serine
Phenylalanine	Norleucine
Leucine	Aspartic acid
Isoleucine	Glutamic acid
Threonine	Hydroxyglutamic acid
Methionine	Proline
Valine	Hydroxyproline
Arginine *	Citrulline
	Tyrosine
	Cystine

* Arginine can be synthesized by the animal organism, but not at a sufficiently rapid rate to meet the demands for normal growth.

Subsequent work on human subjects has demonstrated that only eight of the ten amino acids listed as essential for growth are required for maintenance of nitrogen equilibrium in man. (Nitrogen equilibrium means that the loss of nitrogen in the excreta is approximately equal to the intake of nitrogen in the food.) Histidine and arginine are of doubtful significance for the adult human, but they may be necessary for growth of children, as they are for growth of animals. Further work will ultimately be done to determine the daily requirements of the amino acids necessary for growth and maintenance in humans. Such findings will be of practical value in calculating protein requirements when the protein is drawn from widely varied food sources.

A man may be maintained in nitrogen equilibrium on a mixture of pure amino acids. This fact changes our earlier concept of the place of protein in the diet. Strictly speaking, it can no longer be said that protein, as such, is necessary for life, but rather that essential amino acids are necessary. Natural proteins may be hydrolyzed by the action of enzymes or acids to form protein hydrolysates, mixtures of the amino acids present in the protein. Practical use is being made of such protein hydrolysates for intravenous feeding in certain surgical and accident cases, and for oral administration after prolonged starvation and in other cases where rapid assimilation of nutrients is essential.

QUALITY OF PROTEINS

Proteins in natural foods differ widely in the number and the proportion of the 22 amino acids that they contain. A good-quality protein or a complete protein is one that supplies all the essential amino acids in sufficient quantities for normal growth and maintenance. When tested experimentally, proteins such as ovovitellin from egg yolk or lactalbumin from milk are capable of supporting growth in young rats when fed at a relatively low level in the ration. This indicates that they top the list of good-quality proteins. In general, all proteins from animal sources, such as meats, poultry, fish, eggs, milk and cheese, provide good-quality proteins in liberal amounts. (See Fig. 7.) The exception to this is the pure protein—gelatin—derived from animal connective tissue, an example of incomplete protein.

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[1] Rose, W. C.: Physiol. Rev. **18**:109, 1938.

Sherman[2] differentiates between partially incomplete and incomplete proteins. He defines a partially incomplete protein as one capable of maintaining life but not of supporting normal growth. The gliadin of wheat is an example of this type of protein. Incomplete proteins are those which by themselves are incapable either of maintaining life or of supporting growth. Zein of corn and gelatin belong to this class. The value of a protein is determined both by quality and by the quantity of the amino acids it contains.

Fortunately, most of our foods contain not a single protein, but a mixture of proteins, one of which often supplements the deficiencies of the others. Corn, as an example, does not manifest the degree of deficiency exhibited by its principal protein—zein. There are at least two other proteins in corn that partially, at least, make up for the deficiencies of zein. Likewise, in a mixture of foods, the deficiencies of one may be made up by abundant quantities in another. Milk, for example, is an excellent supplement to cereals that lack one or more of the essential "building stones." It is clear, therefore, that a varied diet is much to be preferred to a restricted one.

PROTEIN METABOLISM

The digestion of protein in the alimentary tract is accomplished by the action of the three proteolytic enzymes—pepsin, trypsin and erepsin—(see Chap. 10). The end products of this enzymatic hydrolysis in the stomach and the intestines are the 22 amino acids with sometimes small traces of dipeptides (compounds of two amino acids) that escaped being split apart. The amino acids are absorbed directly into the blood stream through the intestinal capillaries and are carried by the portal blood first to the liver and then to all tissues and organs of the body.

The body makes such combinations of these amino acids as are necessary to build up its own kind of body protein, providing the essential amino acids are present in adequate amounts. No two types of tissue have exactly the same composition; muscle, liver, kidney, blood, skin, etc., must each have the specific types and amounts of these "building stones" to complete its structure or replace used materials. Enzymes, hormones and internal secretions each contain combinations of specific amino acids or their derivatives.

After the blood stream has delivered the requisite amino acids to the various tissues and has collected the discard or surplus amino acids from the tissues, it carries them back to the liver. Neither surplus protein nor amino acids can be stored to any extent in the body. The liver serves as a redistribution and disposal center for amino acids. Those not needed are deaminized; that is, the nitrogen part (NH_2) is split off and the nonnitrogenous part is used along with sugars and fats for fuel. Slightly more than half of the protein molecule may be converted into sugar-like compounds (glucogenic) to be used as an immediate source of energy, stored as glycogen or converted into fat for storage as adipose tissue. The ultimate end products of the oxidation of this portion of the protein molecule are CO_2 and H_2O, just as for fat and sugar.

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[2] Sherman, H. C.: Chemistry of Food and Nutrition, New York, Macmillan, 1946.

The nitrogenous portion of the amino acids split off by enzyme action in the liver may be used again in the resynthesis of certain simple amino acids needed by the body, or it may be discarded. The largest proportion is waste nitrogen, and most of it is formed into the simple compound urea by the liver cells and in that form is transported by the blood to the kidneys for excretion.

Protein is more complex than the preceding paragraphs may imply. All body tissues are constantly undergoing metabolic changes, sometimes referred to as wear and tear. The body cells are not stable chemical combinations that remain static once they are formed: modern research has demonstrated that all tissues are in a state of dynamic equilibrium, which means that they maintain a constant composition while certain components are breaking away and being replaced by others derived from food or the body's current surplus.

The very nature of the chemical processes involved in the metabolic breakdown indicate that protein is not an economical fuel food. Furthermore, the specific dynamic action of protein, explained briefly in Chapter 6, means that the body is stimulated to spend more energy as a result of protein ingestion. However, from a practical point of view, man's choice of food protein should provide an intake well above actual needs to make sure of an adequate supply of the essential amino acids. The necessary margin of safety means that there will usually be a surplus that must be deaminized and used like a fuel food, just as surplus scrap wood left from building a house may be used for fuel, although the original material was not procured for that purpose.

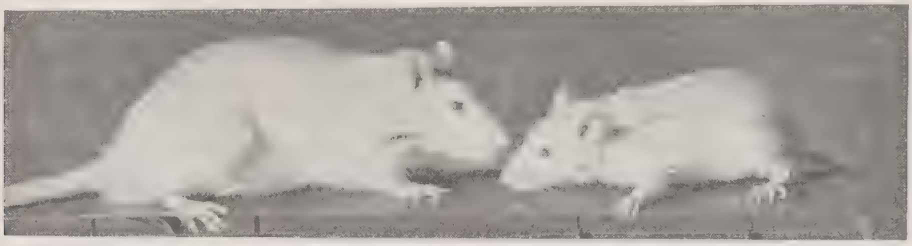

FIG. 6. Adequate and inadequate protein (18 per cent vs. 4 per cent). Rats of the same litter. This deficiency produces stunted growth, but no deformities.

PROTEIN REQUIREMENTS

Any quantitative estimate of protein requirement must take into account the quality of proteins involved. The

Food and Nutrition Board recommended allowances of 70 and 60 Gm. of protein per day for men and women, respectively (i.e., from 10 to 15 per cent of the total calories), in line with the earlier estimates given by Sherman[3] (1 Gm. per Kg. of body weight per day). The allowances for growing children are higher per unit of weight to meet the needs for growth. The pregnant and nursing mother naturally needs an extra supply to provide for the nourishment of two organisms. (See Recommended Dietary Allowances, Chap. 11.)

The trend at the present time is toward an increasingly liberal protein allowance for all ages, to provide for less obvious needs as well as growth

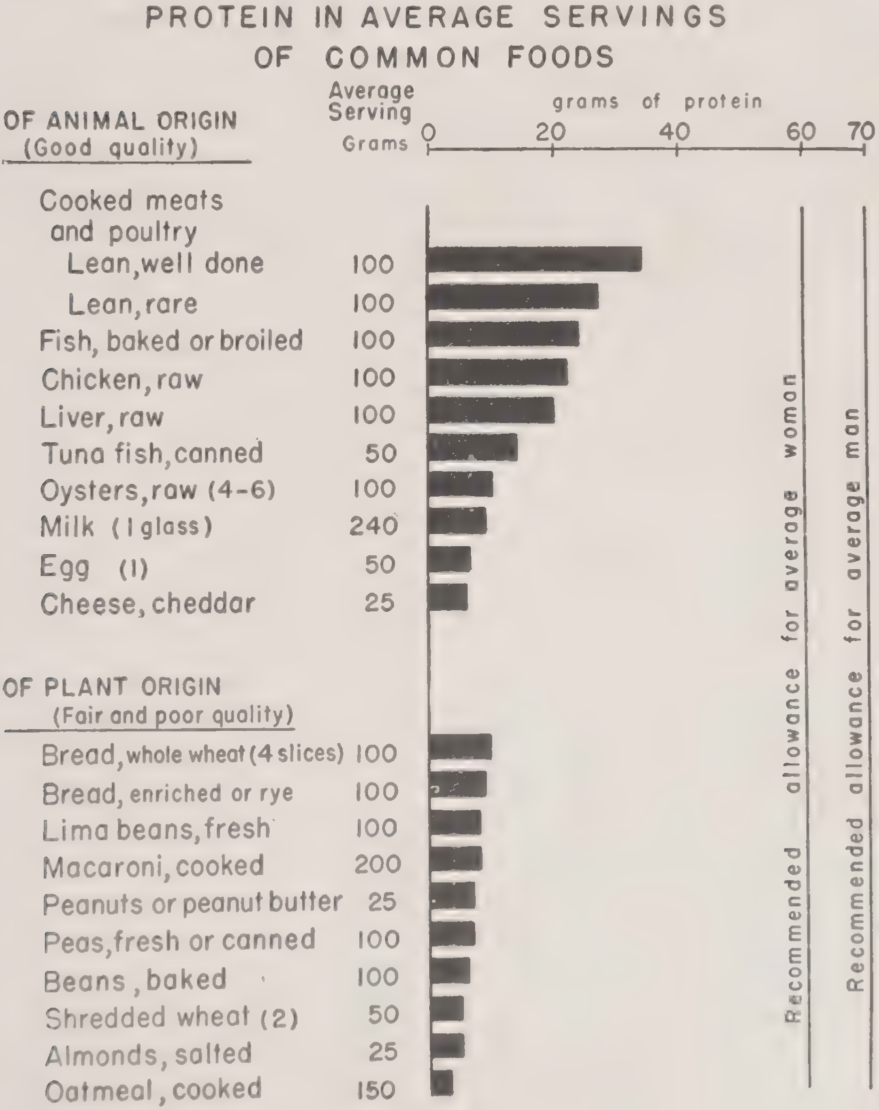

Fig. 7.

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[3] *Ibid.*

and maintenance. It is sug[illegible] instance, that a liberal [illegible] tends to increase immuni[illegible] ance to infections. How[illegible] mental evidence and [illegible] wartime restrictions [illegible] human body has a[illegible] itself to widely diff[illegible] of intake. Scientific [illegible] people living on [illegible]ed food supplies, lo[illegible] and of poor quality, du[illegible]d War II afford further ev[illegible] regarding the amazing human adap[illegible]ch restrictions. When [illegible] being conducted in several European countries can be evaluated and reported, they may help to settle several questions regarding minimum protein requirements versus liberal protein allowances.

[illegible] Food for One Day	Measure	Approximate Protein Contribution Gm.
Milk or its equivalent	1 pint, 480 Gm.	17
Meat, poultry or fish, cooked	1 serving, 100 Gm.	27
Egg (1)	50 Gm.	7
One additional protein food *	1 serving	7
Fruit, fresh, canned or frozen, 1 citrus	2 servings, 200 Gm.	2
Vegetables	3 servings	
1 green or yellow	100 Gm.	2
1 other	100 Gm.	2
potato	100 Gm.	2
Bread, whole-grain or enriched	3 slices, 90 Gm.	9
Cereal, whole-grain or fortified	1 serving, 20 Gm.	3
Butter or margarine	3 pats, 30 Gm.	..
Total		78

* Calculated as an average of meat, cheese, egg and milk.

In ordinary peacetime circumstances, and with a moderate income, the average person is apt to meet his protein requirement without difficulty. It is usually considered desirable for about one third of the pro[illegible] derived from animal sources [illegible] recommended allowances [illegible]his assumption. Since protein [illegible] of high biologic value are the [illegible]st expensive class of foods in the [illegible]iet, there is a tendency among some low-income groups to consume less than recommended amounts of protein and often of poorer quality. From the chart (Fig. 7) it is easy to estimate the number of servings of protein foods necessary to meet the day's recommended allowance.

A basic dietary pattern for one person for a day is often used in planning menus for institutions such as hospitals. This dietary pattern, planned for a sedentary person and using somewhat smaller portions than those given in the chart, may still provide enough protein to meet recommendations.

The protein requirement may be modified by certain pathologic and environmental conditions. Theoretically, hard physical labor increases caloric but not protein requirement

However, in actual life, men engaged in heavy work want protein in about the same proportion as calories, and this means that the protein intake is more than that recommended for active men. During convalescence from debilitating diseases or from surgery, extra protein seems to hasten recovery and the regaining of strength. In cold climates a higher protein intake may be desirable due to the specific dynamic action which tends to increase body-heat production. The earlier tendency to reduce protein intake in certain diseases has been rather generally reversed due to recent favorable results from the use of more liberal protein diets.

The history of investigation into human protein requirements abounds in contrasting opinions. Early investigators of the subject advocated from 100 to 150 Gm. of protein as a daily optimum, the figures being based on observations of what people were actually eating. The estimates tended to be high because meat consumption was liberal in the eighteenth century in Central Europe where these scientists were living. Early in this century, Chittenden, at Yale, conducted a scientific study of a number of students and faculty, and found that they could remain in nitrogen equilibrium on less than a third of the amount of protein previously considered necessary. Other investigators championed the cause of low protein, believing that the products resulting from protein metabolism, in excess of actual body needs were harmful. More recently the emphasis has been on an adequate supply of good-quality protein well above the minimum requirements as measured by nitrogen-balance experiments.

FOOD SOURCES OF PROTEIN

Proteins are found both in animal and [illegible] foods, as is evident from Fig[illegible] 39. Animal products i[illegible] provide more protein per se[illegible]ll as more complete protein[illegible]st-quality proteins from p[illegible] are found in legumes, n[illegible]reen leaves. When combine[illegible] meals, the proteins from [illegible] sources tend to supplement [illegible]her. If the protein [illegible] largely from plant sou[illegible]ssential to ensure an a[illegible] sufficient amounts of a[illegible].

Ce[illegible] while containing not more than 12 per cent of protein, and that not of the best quality, make a worthwhile contribution to the protein intake because of the extent to which they are used. Cereal products may contribute one half the protein in certain countries where foods of animal origin are scarce. When cereals are used with milk products or with meats, the proteins tend to supplement each other in value.

Proteins are somewhat modified in physical properties and in physiologic availability by heat. In ordinary cooking, proteins such as those in egg, meat and fish are coagulated by heat. Low-temperature cooking produces a tender product, while high temperatures tend to cause toughening. An egg cooked below the boiling point is more tender than a "boiled" egg. Meat-cookery experts recommend temperatures between 300 and 350° F. for the best results, for the same reason as well as to lessen shrinkage. The nutritive values of soybean protein is improved by autoclaving soybeans before processing as flour or grits. In general, heat does not reduce

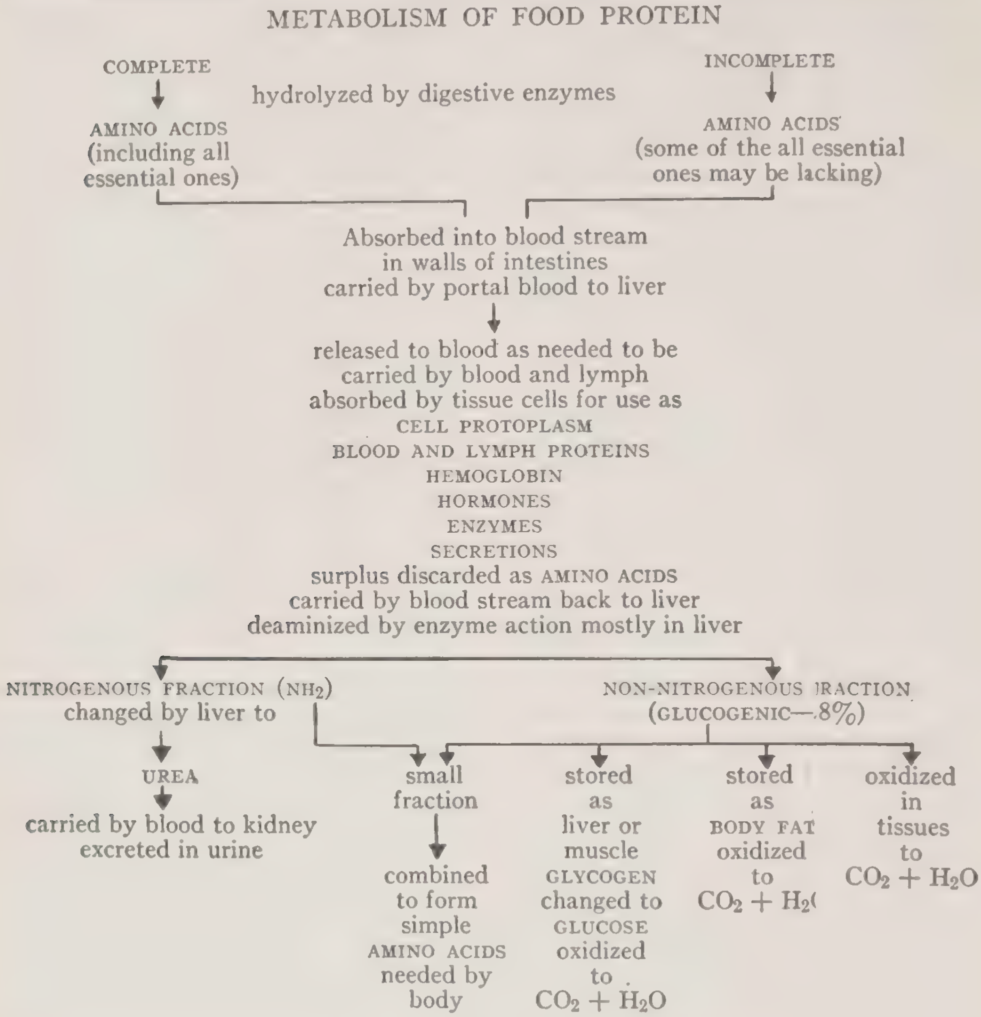
METABOLISM OF FOOD PROTEIN
COMPLETE
hydrolyzed by digestive enzymes
INCOMPLETE
AMINO ACIDS (including all essential ones)
AMINO ACIDS (some of the all essential ones may be lacking)
Absorbed into blood stream in walls of intestines carried by portal blood to liver
released to blood as needed to be carried by blood and lymph absorbed by tissue cells for use as
CELL PROTOPLASM
BLOOD AND LYMPH PROTEINS
HEMOGLOBIN
HORMONES
ENZYMES
SECRETIONS
surplus discarded as AMINO ACIDS carried by blood stream back to liver deaminized by enzyme action mostly in liver
NITROGENOUS FRACTION (NH2) changed by liver to
NON-NITROGENOUS FRACTION (GLUCOGENIC—.8%)
UREA
carried by blood to kidney excreted in urine
small fraction
combined to form simple AMINO ACIDS needed by body
stored as liver or muscle GLYCOGEN changed to GLUCOSE oxidized to CO2 + H2O
stored as BODY FAT oxidized to CO2 + H2O
oxidized in tissues to CO2 + H2O

FIG. 8.

the digestibility of vegetable proteins and may even improve availability.

The per cent of protein in cooked foods, either meat or vegetables, depends upon the amount of moisture that may have been added or lost in cooking. Compare the protein content of rare and well-done meat in Figure 7 on page 39. Also compare the protein content of raw and cooked oatmeal, raw and French-fried potatoes. (See Table 1, Part Four.)

REVIEW QUESTIONS

1. Growth at the normal rapid rate of early childhood involves the conversion of a considerable proportion of the food protein into body tissue. What factors are essential and how can an adequate supply be ensured?

2. How can you plan to get enough protein in your everyday meals without actually calculating the protein intake exactly?

3. Why would you expect the proteins of milk and eggs to be of higher nutritive value even than those of muscle meats or fish?

4. If animal foods are limited in quantity, how can an adequate distribution of amino acids be derived largely from plant foods?

5. It has been observed that children in war-torn countries are under height for their age, even when not under weight for their height. How would you explain this if they had been getting better than one gram of protein per kilogram of body weight?

6. Recommended protein allowances have been listed by the Food and Nutrition Board for men and women and for children of different age groups. Calculate these values on the basis of grams of protein per kilogram of body weight.

7. The so-called high-protein foods listed in the chart contain appreciable amounts of other food constituents. Look up each of the foods listed and tabulate its fat and carbohydrate content.

6

Energy Metabolism

Chapter Topics

ENERGY AND HEAT
  MEASURING FUEL VALUES
BASAL METABOLISM
  VARIATIONS IN METABOLIC RATES
  PREGNANCY AND LACTATION
WORK AND FUEL REQUIREMENTS
EFFECT OF FOOD ON THE METABOLIC RATE
OTHER FACTORS AFFECTING METABOLISM

Of all the sun's energy that reaches the earth, only a small fraction can be stored for future use. The plant world is amazingly efficient in transforming heat and light from the sun into forms of potential chemical energy which the animal world, in turn, spends in the form of heat and work. Carbohydrate is the chief form of stored energy in plants, fat the chief form in animals. The story of energy metabolism is concerned with the transforming and the spending of energy by the human body.

Metabolism is a term used to designate the chemical changes that take place in the body through the action of its cells. Metabolism includes many activities; among them the changes in the foodstuffs after absorption from the alimentary tract. These changes, which result ultimately in the combustion of foodstuffs, with the release of heat or energy, constitute what is called energy metabolism.

ENERGY AND HEAT

Energy is expended whenever work is performed by the body in the completion of any act, small or large. It matters not whether the action is voluntary—such as walking, sitting, and the various acts involved in the performance of one's daily work—or involuntary—such as in the circulation of the blood, respiration, digestion, and the maintenance of muscular tension or tone.

Just as the furnace must frequently be fed with fuel in order to meet the expenditure of energy in the form of heat given out, so must the body be supplied with food as a source of energy for warmth and work. There is a direct relation between the amount of work performed, the heat produced by the body and the total food intake. One cannot perform more work than is provided for by the food intake unless one "borrows" from the reserve supply stored as adipose tissue or as glycogen in the liver or the muscles. This "borrowing" habit is a bad one. The average daily intake should equal, or slightly exceed, the daily energy requirement, except in cases of obesity, when it should be slightly lower.

Heat in Relation to Metabolism. Heat is an accompaniment of combustion and likewise of energy production; therefore, it can serve as a measure of energy metabolism. The calorie has long been used as the measure of heat. Just as it is necessary to have measures of length (centimeter, inch, foot), measures of weight (gram, ounce), and measures of volume (pint, quart, liter), so it is necessary in scientific work to have a measure of heat. A calorie is the amount of heat required to raise the temperature of one kilogram of water one degree centigrade. In our more common measures, it is approximately the amount of heat required to raise four pounds of water one degree Fahrenheit.

Measuring Fuel Values

Bomb Calorimeter. The measuring of heat in terms of calories involves the determination of temperature change as well as of the weight and the type of material to which the heat is transmitted. Heat travels rapidly and, therefore, must be confined for accurate measurement. This is accomplished by means of an apparatus designed for the purpose. A small instrument used for food determinations is known as the bomb calorimeter. It is so called because the metal container in which a weighed portion of food or other combustible material is burned resembles a bomb. The bomb is suspended in a weighed amount of water in a thermos container inside a well-insulated box. The bomb is filled with oxygen under pressure to ensure enough oxygen for complete combustion. When all is in readiness, a small electric wire, dipping into the tiny dish of food, is charged with sufficient electricity to start combustion, just as a match starts fire in the stove. The heat produced by the burning of the food is transferred to the water, in which is immersed an accurate thermometer. Thermometer readings are taken before the oxidation begins and every half minute until the maximum rise in temperature of water is reached (6 to 10 minutes), and from the dif-

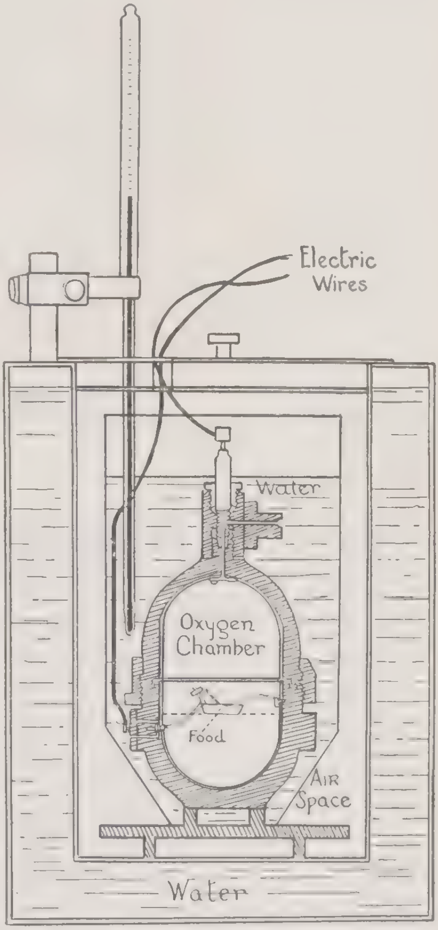

Fig. 9. Diagram of the parts of a bomb calorimeter. The water in the inner chamber changes in temperature when the food is burned. The water in the outer chamber acts with the intervening air space as insulation. (Jean Broadhurst.)

ference or total rise in temperature may be calculated the caloric or fuel value of the food being tested.

Fuel values of foods burned within the body are slightly less than when burned in the bomb calorimeter. Some types of food are used more completely than others, and some substances with calorie value are excreted in the urine. Atwater's method of calculation of the fuel value of foods, first published in 1900, is still in use in the United States. Based on the distribution of common foods in a mixed diet, he calculated that for each gram of food material consumed, the values indicated in the following table were available for the body. These are known as the physiologic fuel values, and are the ones used in most dietary calculations:

Carbohydrate	4 calories per gram
Fat	9 calories per gram
Protein	4 calories per gram

In Great Britain there are significant differences[1] in the method of calculation of fuel values and in the factors used. These differences were of minor importance in prewar days, except that research data from the two countries were not entirely comparable. In wartime calculation of national food supplies these differences became more important in establishing a fair distribution of available foods. Thus the method of calculating fuel values of foods has come up for critical review, and some changes may be recommended in the future. In Table 1 of Part Four in this book the factors 4, 9, 4 have been used in calculating calorie values in the conventional manner recommended by Atwater and reaffirmed by Maynard.[2]

The actual energy expended by the body throughout a given period may be determined by placing a human subject in a special calorimeter, just as food is enclosed in the bomb calorimeter. The heat given off by the subject is absorbed by the water in the coils surrounding the well-insulated chamber, where, by an accurate mechanism, the total heat may be measured. This procedure is known as direct calorimetry.

As there are in existence only a few calorimeters large enough for making direct observations on human beings, and since they are exceedingly expensive, this method is used chiefly for scientific research. By another method, known as indirect calorimetry, the rate of metabolism is calculated from the oxygen intake measured by a respiration apparatus. From the oxygen consumed in a given number of minutes the caloric expenditure can be calculated because the average caloric equivalent of a liter of oxygen for a person on a mixed diet has been determined to be 4.825 calories. The calculation is made easy by accurately ruled paper used on the recording drum and carefully regulated speed of the drum.

The subject lies on a cot and breathes through a nose piece or a mouth piece, the subject himself forming a "closed circuit" and using only oxygen from a measured supply. This type of apparatus is now installed in most of the larger hospitals of the country. The metabolism test is used extensively as a means of diagnosis, particularly in cases of hyperthyroidism, hypothyroidism, myxedema and other endocrine disturbances which may alter the metabolic rate.

[1] Maynard, L. A.: J. Nutrition 28:443, 1944.

[2] *Ibid.*

BASAL METABOLISM

In order that there may be some basis of comparison for such tests, the rate of metabolism must be studied under standard conditions. It is therefore specified that the subject be awake but at complete rest, and that the test be taken at least 12 hours after the last meal and several hours after any vigorous exercise. The rate of metabolism as determined under these "standard" conditions is known as the basal rate, and is often spoken of as the basal metabolism. Marked variations in the basal rate of metabolism are an indication of disease.

Variations in Metabolic Rates

However, there are lesser and wholly normal variations, the causes of which lie within the body itself: the size, the shape and the composition of the body; the age of the individual and the activity of certain internal glands. It is generally accepted that a variation of not more than 10 per cent either way from the accepted metabolic rate (all variables considered) is within normal limits.

The surface area of the body is used as a measure of size in these studies. The skin of the body is a radiating surface from which heat is given off continually. Therefore, the greater the skin area, the greater will be the amount of heat lost by the body and, in turn, the greater the necessary heat production by the individual. It has been found that a tall, slender person has a greater surface area than

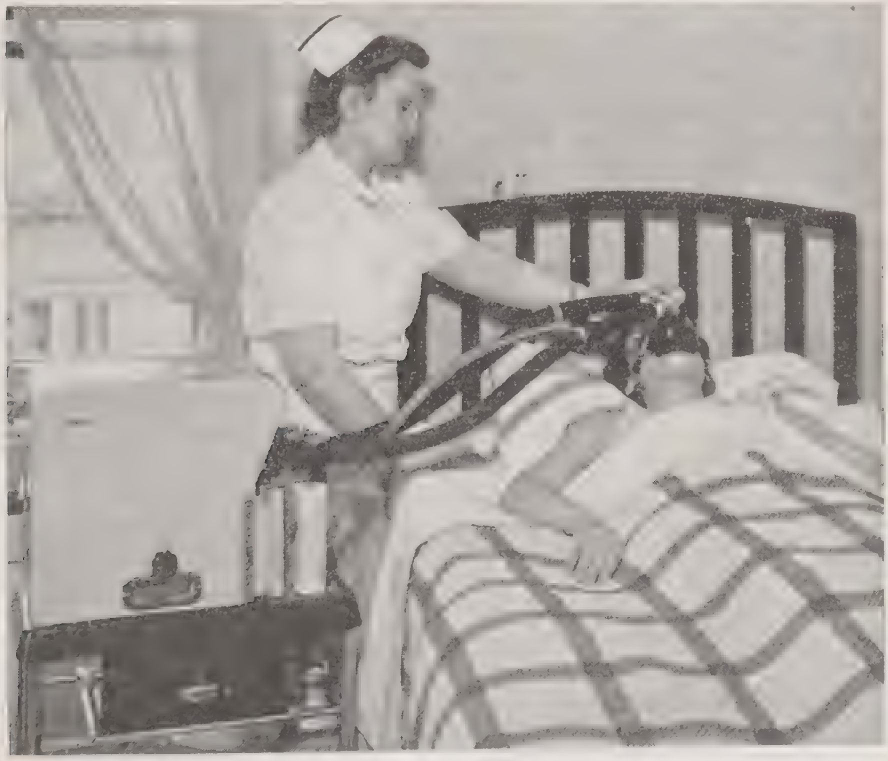

Fig. 16. A respiration apparatus for making basal metabolism measurements. (McKesson Appliance Co.)

a shorter stout person of the same weight; that is, surface area is proportional to height multiplied by weight. The basal metabolism of an average man and woman would be about 1,700 or 1,400 calories, respectively. A large proportion of adipose tissue lowers the metabolic rate, as the muscular tissues are the chief seat of energy metabolism. Complete tables of average metabolic rates for men and women of different age, height and weight are used for comparison with the measured rate. More than 10 per cent above or below the average is considered abnormal.

Age and growth are responsible for normal variations in basal metabolism. The relative rate is highest during the first and second years, and decreases after that, although it is still relatively high through the ages of puberty both in girls and in boys. During adult life there is a steady decrease in rate with a marked drop in old age, due undoubtedly to lower muscle tone resulting from diminishing muscular activity.

Sex probably has little effect upon metabolism, although women in general have a lower metabolism than men; but this may be because women are usually smaller and less active. However, Benedict[3] found that women of the same height and weight as men had a metabolic rate that was about 5 per cent lower than that of men. He accounts for this by a difference in body composition, women usually having a little more fat and less muscular development than men. However, there are certain increases in metabolism that are incident to the female sex.

The internal secretions of certain glands of the body, such as the thyroid and the adrenals, materially affect metabolism. The secretion of the thyroid gland has the most marked effect. Hyperthyroidism is that condition in which the metabolism is accelerated by an increased production of thyroid extract, while hypothyroidism is characterized by a decrease from the normal amount resulting in subnormal metabolism. Other glandular secretions may affect metabolism to a lesser degree, but their significance in this respect is not well understood.

Pregnancy and Lactation

The fetus has a much higher rate of metabolism than that of the maternal organism, but its size is so small during the first three or four months of pregnancy that it makes no appreciable difference in the mother's food requirements. From the fifth month on, the metabolic rate increases as the size increases, so that at the time of delivery the total metabolism of mother and fetus has increased from 20 to 25 per cent over that of the mother before conception.

The Infant. During lactation the mother's food must supply not only her own needs but those of the baby's body as well. Like the fetus, the infant has a much higher metabolic rate per pound of body weight than the mother. This is due to the rapid rate of growth. The food needs of an infant up to 3 months of age are about 60 calories per pound, decreasing thereafter to about 50 calories at 6 months, 45 calories between 6 and 9 months, and 40 calories from 9 to 12 months. A 10-pound baby, 5 months of age, would therefore add at least 500 calories to the food requirements of a nursing mother. For more detailed information on the energy requirements of an infant see Chapter 16. Nursing mothers usually require from 2,600 to 2,900 calories per day. Some pediatricians place the requirements slightly higher, especially so if the mother is engaged in active work.

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[3] Benedict, F. G., and L. E. Emmes: J. Biol. Chem. 20:253, 1915.

WORK AND FUEL REQUIREMENTS

Body work is of two kinds, voluntary and involuntary. There is during waking hours an almost constant movement of some part of the body, bringing into play the voluntary muscles, but by far the greater proportion of body work is carried on by the unceasing activity of the involuntary

ENERGY EXPENDITURE PER HOUR UNDER DIFFERENT CONDITIONS OF MUSCULAR ACTIVITY

Form of Activity	Calories per Hour		
	Per 70 Kilograms (average man)	Per Kilogram	Per Pound
Sleeping	65	0.93	0.43
Awake lying still	77	1.10	0.50
Sitting at rest	100	1.43	0.65
Reading aloud	105	1.50	0.69
Standing relaxed	105	1.50	0.69
Hand sewing	111	1.59	0.72
Standing at attention	115	1.63	0.74
Knitting (23 stitches per minute on sweater)	116	1.66	0.75
Dressing and undressing	118	1.69	0.77
Singing	122	1.74	0.79
Tailoring	135	1.93	0.88
Typewriting rapidly	140	2.00	0.91
Ironing (with 5-pound iron)	144	2.06	0.93
Dishwashing (plates, bowls, cups and saucers)	144	2.06	0.93
Sweeping bare floor (38 strokes a minute)	169	2.41	1.09
Bookbinding	170	2.43	1.10
"Light exercise"	170	2.43	1.10
Shoemaking	180	2.57	1.17
Walking slowly (2.6 miles per hour)	200	2.86	1.30
Carpentry, metal working, industrial painting	240	3.43	1.56
"Active exercise"	290	4.14	1.88
Walking moderately fast (3.75 miles per hour)	300	4.28	1.95
Walking downstairs	364	5.20	2.36
Stoneworking	400	5.71	2.60
"Severe exercise"	450	6.43	2.92
Sawing wood	480	6.86	3.12
Swimming	500	7.14	3.25
Running (5.3 miles per hour)	570	8.14	3.70
"Very severe exercise"	600	8.57	3.90
Walking very fast (5.3 miles per hour)	650	9.28	4.22
Walking upstairs	1,100	15.80	7.18

muscles. The work of the circulatory and the respiratory systems never stops so long as life persists; the digestive processes go forward without conscious attention. The muscles are always in a slightly contracted state. For all these forms of involuntary work, energy or fuel is required. For all voluntary activities the fuel needed is in direct relation to the intensity of the exercise. For instance, a moderate amount of energy is needed for walking, while for the heavy labor of digging a ditch or for the active exercise of tennis an enormous amount of fuel is needed.

Muscular work is the greatest factor influencing dietary requirements. Mental work, strange as it may seem, does not affect the total metabolism sufficiently to be detected by the calorimeter. Investigators, working with a very delicate apparatus, found that nerve tissue did expend some energy, but that the amount expended by this tissue was very small indeed compared with the total energy of the body. In exceptional cases, physical work may be the means of increasing the metabolism by as much as 4,000 calories. The food intake should in every case equal in caloric value the heat units expended by the body (except, of course, in overweight individuals who find it necessary to reduce). A man doing sedentary work may require only 2,500 calories per day, while a man doing exceedingly hard manual labor may require as much as from 5,000 to 6,000 calories. The data[4] on page 49 from various metabolism studies have been arranged for reference on the basis of a man of average size—70 Kg., or 154 pounds, or per unit of weight that can be applied for men or women. The calories for each activity listed include basal plus the extra calories spent for work. From it one may easily calculate the approximate calories required for these vocations and for others that would require similar exertion.

Tigerstedt[5] estimated the energy requirements of those in some of the more common occupations as follows:

2,000-2,400 calories per day suffice for a shoemaker.
2,400-2,700 calories per day suffice for a weaver.
2,700-3,200 calories per day suffice for a carpenter or mason.
3,200-4,100 calories per day suffice for a farm laborer.
4,100-5,000 calories per day suffice for an excavator.
Over 5,000 calories per day are required by a lumberman.

A nurse weighing 130 pounds and on active duty 8 hours a day might estimate her total energy expenditure for the 24 hours as given on page 51.

An office girl with less activity would expend considerably less calories, but a man weighing more and in sedentary occupation may expend about the same calories as the more active woman.

It is suggested that the reader work out a table of food requirements based upon his own program of work: it may prove interesting as well as enlightening.

A person who habitually consumes more calories than he expends for work plus body heat tends to store the extra food as body fat (adipose tissue). This is easy to do, especially when one's activities are less than previously. Eating habits are frequently not adjusted to fit reduced

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[4] Sherman, H. C.: Chemistry of Food and Nutrition, New York, Macmillan, 1946.

[5] Tigerstedt, Robt. A. A.: Text Book of Physiology, Leipzig, Hirzel, 1897.

Nurse's Activities	Time Hours	Calories per Pound	
		Per Hour	Total
Sleeping	8	.43	3.44
Lying still, reading	1	.50	.50
Dressing and undressing	1	.77	.77
Sitting, eating meals, knitting, etc.	5	.75	3.75
On duty, 8 hours			
Care of patient, lifting, walking, carrying tray, etc.	4	.93	3.72
Walking downstairs	¼	2.36	.59
Walking upstairs	¼	7.18	1.80
Active exercise	1½	1.88	2.82
Reading aloud to patient	2	.69	1.38
Walking moderately fast, going to and from work	1	1.95	1.95
Total per pound	24		20.72
Multiplied by weight, 130 pounds			× 130
			2,693.60

activities. Therefore, it is not surprising that people tend to gain weight with age; it is more surprising that they do not gain more weight. For some individuals nature provides some sort of metabolic adjustment for disposing of extra calories without increasing body weight. Such people seem to eat all they want and more without gaining weight, and are the envy of their fat friends who enjoy eating but must control appetite if they would control weight. A more complete discussion of weight control and the treatment of obesity is given in Chapter 20.

Habitual muscular exercise not only increases the total energy metabolism but affects the basal rate because energy is required to maintain muscle tone. On the other hand, sleep lowers metabolism because the muscles are relaxed. A prolonged period of absolute rest in bed means loss of muscle tone and lowered metabolism; this explains why rest is a method of treatment in cases of abnormally high metabolic rate.

EFFECT OF FOOD ON THE METABOLIC RATE

The intake of food also increases metabolism. This is most marked after the food products reach the blood stream, the effect being noticed in from one half to five or six hours, depending upon the type and the amount of food consumed. One research worker found that a fasting man had a metabolism averaging 9 per cent lower than what he had on the days when food was consumed. Another worker found a difference of about 22 per cent between the fasting days and the days when a liberal diet was taken. However, metabolism goes on during fasting, showing that the body must continue burning fuel supplies even though the tissues are called upon to make up the deficit. This explains the loss of weight and wasting in severe illness and starvation.

Recent findings would indicate that with prolonged fasting and subsequent loss of weight, the body tends to adjust itself by a lowering of the metabolic rate. This is comparable to setting back a thermostat so that the organism runs at a lower rate. This adjustment is true of adults, but children who are undernourished seem to have a higher rate, which makes undernutrition in children even more serious than in adults. No satisfactory explanation for this difference has yet been found.

Specific Dynamic Action of Protein. Not all kinds of food burn with an equal effect upon metabolism. Protein stimulates metabolism, so that a greater amount of heat is expended in the burning of it than in the burning of similar quantities of fats and carbohydrates. This stimulation is undoubtedly due to certain intermediate products resulting from the splitting of protein in the oxidation processes in the tissues, and is commonly known as the specific dynamic action of protein. Carbohydrates and fats have a much less marked effect, but the slight stimulation that results from the intake of food of any type accounts for the fact that metabolism tests are usually taken before breakfast when no food has been eaten for at least 12 hours. For a person on an average diet the specific dynamic action of food may account for about 10 per cent rise above the basal.

OTHER FACTORS AFFECTING METABOLISM

Climate, season, housing and clothing affect metabolism, chiefly through their bearing upon the regulation of body temperature. The heat produced in the body by metabolic processes must be conserved or given off in such a way as to maintain the body temperature at a remarkably constant figure. If no heat were lost from the body during average daily activity, the temperature would rise about 2 degrees an hour. In winter we purposely curtail our heat loss (through conduction) by wearing heavier clothing and living in heated houses, while in summer we wear thinner clothing to expedite greater losses. However, nature has provided for a carefully controlled loss of heat that may vary as climate and environment dictate. A thinly clothed person on a cold winter day may shiver. This process is a series of rapid muscular contractions set up involuntarily in the body to increase heat production in order to make up for the rapid heat loss. Evaporation or perspiration from the skin is another important mechanism employed by the body in the control of temperature. Insensible perspiration is evaporating continuously with a slight loss of heat, but sensible perspiration means greater heat loss and affords a welcome cooling effect when the body is overheated in warm weather or after strenuous exercise.

Although there are a number of essential nutrients to be considered in the selection of an adequate diet (see succeeding chapters), it must not be forgotten that the caloric value is fundamentally one of the most important, as Du Bois[6] pointed out when he stated:

"Calories in medical practice are just as important as they ever were, in spite of the fact that attention has been centered on vitamins. No supplements of vitamins or mineral elements can alter the laws of the conservation of energy. Calories are still needed to keep the body warm and to furnish energy for muscular work."

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[6] Du Bois, E. F., and W. H. Chambers: J.A.M.A. **119:**1183, 1942.

REVIEW QUESTIONS

1. The calorie is the measure of energy in the form of heat. Using the accepted energy values for protein, fat and carbohydrate, calculate the energy value of a 100-Gm. serving of cooked oatmeal containing 2.3 Gm. protein, 1.2 Gm. fat and 10.8 Gm. carbohydrate.

2. The basal metabolic rate is measured under standard conditions. Would the following conditions be standard: At 11:00 A.M. following breakfast at 7:00 and a half-hour rest period?

3. The basal metabolism of a man of average size is about 1,700 calories per day; of a woman of average size, about 1,400 calories. If the measured basal metabolism for such a person was 12 per cent below average (−12), how many calories per day would each be expending under basal conditions?

4. Muscular work may influence energy expenditure more than any other factor. If the nurse who needed 2,694 calories, as calculated on page 51, were off duty and not active, what would her total caloric requirement be?

5. Constant body weight usually indicates that food is meeting caloric requirements. Calculate your own daily caloric requirement from the table on page 49 and the energy value of your food for the same day from Table 1, Part Four.

6. Factors influencing total metabolic rate are age, size, sex, activity, climate, housing and clothing. Which of these has the most effect, and why? Which the least?

7. When there are acute food shortages, as there were during and immediately after the war in many parts of the world, should relief agencies supplying a minimum of food to relieve starvation think first of calories, protein or vitamins, and why?

7

Minerals

Chapter Topics

CALCIUM AND PHOSPHORUS
IRON
IODINE
SODIUM, POTASSIUM, MAGNESIUM, SULFUR AND CHLORINE
TRACE ELEMENTS
ACID-BASE BALANCE

Of the many chemical elements that make up the cells of the human body, carbon (C), hydrogen (H), oxygen (O) and nitrogen (N) constitute about 96 per cent by weight. The remaining 4 per cent or less (approximately 6.6 lbs. or 3,000 Gm.) is largely composed of the mineral salts or ash constituents found as inorganic salts or combined with organic compounds in the body. Those which are most important as structural or functional elements are present in approximately the proportions given in the accompanying table for an adult man:

MINERAL COMPOSITION OF AN ADULT HUMAN BODY[1]

Element	Per Cent of Total Ash	Gm./70 Kilo Man
Calcium (Ca) *	39	1,160
Phosphorus (P) *	22	670
Potassium (K)	5	150
Sulfur (S)	4	112
Chlorine (Cl)	3	85
Sodium (Na)	2	63
Magnesium (Mg)	0.7	21
Iron (Fe)	.15	4.5
Iodine (I)	.0007	.02
Manganese (Mn), Copper (Cu), Cobalt (Co), Nickel (Ni), Fluorine (Fl), Zinc (Zn), Aluminum (Al), Arsenic (As), Bromine (Br), Silicon (Si) and Selenium (Se)	Traces	

* Amounts of calcium and phosphorus are variable according to the bone composition and the reserves of these elements in bone.

In natural foods, minerals are present in various forms mixed with or combined with proteins, fats and carbohydrates. Processed or refined foods such as fats, oils, sugar and cornstarch contain almost no minerals. The total mineral content of a food is determined by burning the organic or combustible part of a known amount of a food and weighing the resulting ash. The ash is then analyzed for individual mineral elements. Most foods have been analyzed for ten or more mineral elements, but in dietary practice the figures most commonly used are those for calcium, phosphorus and iron. These are in Table 1, Part 4.

Accurate data on the mineral constituents of common foods no longer satisfy the scientific nutritionist. The question of relative availability of mineral elements in various forms for physiologic processes has stimulated new investigations in this field. In discussions of the subject written 30 or more years ago the opinion prevailed that the organic forms of minerals found in plant and in animal foods were better utilized than the inorganic. However, modern research has disproven this theory. This concept may have arisen because natural sources provided food essentials other than minerals. With the exception of sulfur, minerals in inorganic combination are in general more readily absorbed and assimilated by animals than minerals incorporated in organic complexes. Moreover, much of the mineral in common foods is really in the inorganic state, contrary to previous belief. Many of the organic mineral complexes must be broken down by physiologic processes to liberate the inorganic minerals for their functions in the body.

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[1] Shohl, A. T.: Mineral Metabolism, New York, Reinhold, 1939.

The available food tables (see Table 1, Part Four) giving mineral content of foods do not tell us how much of these minerals is available. Until such information is obtained and recorded, we must accept and use tables of the total mineral in foods with recognition of this discrepancy.

CALCIUM AND PHOSPHORUS

Calcium is the mineral most likely to be deficient in the average American diet, and phosphorus also is found to be low in many cases. Since calcium and phosphorus are found frequently in the same foods and function together as calcium-phosphate in the building of bone, they may be considered together.

Function. Ninety-nine per cent of the calcium in our bodies and a large percentage of the phosphorus are found as normal constituents of bone, giving to it strength and rigidity. When calcium phosphate is removed from bone, the remaining tissue is as flexible as cartilage; in fact, it is essentially the same as cartilage. Cartilage precedes bone in the development of the fetus and the young animal, and the calcium phosphate is normally deposited in it as growth and strain demand. When nature's plan is thwarted by an inadequate supply of either of these minerals in food, or by an inability to utilize them, growth may be retarded; or, as more often happens, growth in size continues but the normal development of the bone is interfered with, resulting in the bowed legs, enlarged ankles and wrists, prolapsed thorax and other bone deformities characteristic of rickets.

Calcium and phosphorus perform other less conspicuous but necessary functions in the body, of which only a few can be mentioned here. Calcium in the blood is necessary for the process of clotting. Physicians sometimes prescribe a calcium compound as a preparatory measure for an operation, such as tonsillectomy, in an attempt to increase the speed of clotting and thus reduce the loss of blood. Phosphorus is a necessary constituent of every cell in the body and is especially important in nerve tissue. Phosphates also play an important role in utilizing organic foodstuffs and in maintaining the acid-base balance of the blood. Further consideration will be given this function in the discussion of the acid-base equilibrium in the body.

Dietary Requirement for Calcium and Phosphorus. Extensive studies have been made by Sherman[2] and others of the daily requirement of calcium and phosphorus for adults and children. Work had previously been done on animals, but exact data on human beings were lacking. The problem has been attacked by comparing the calcium and the phosphorus in the food with amounts excreted in both the urine and the feces. The examination of urine only, on the assumption that what was lost in feces had never been assimilated, has been proven inaccurate, since some of the metabolized calcium and phosphorus may be excreted through the intestinal tract.

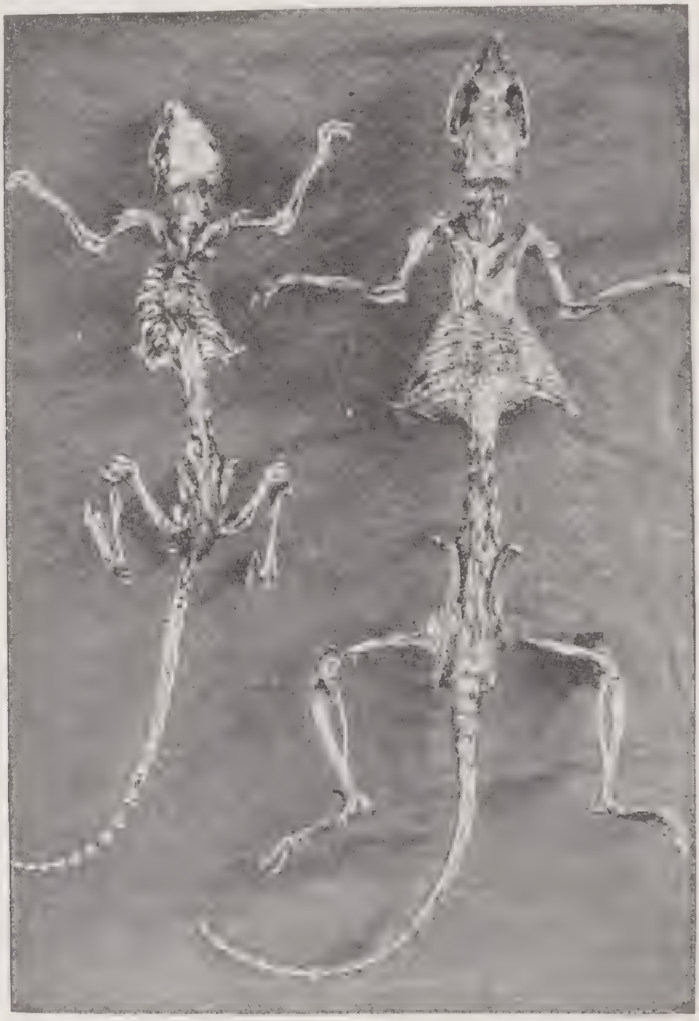

Fig. 11. Diet deficient in calcium compared with normal diet (in rats). Note spinal curvature, deformed ribs and stunting. (See p. 55 for relation of calcium to rickets.)

The maintenance requirement for adults was determined by finding the smallest intake upon which an equilibrium could be maintained, i.e., on which the total amount excreted by a given individual would be no greater than the amount taken in. The results from 97 experiments carried out in this fashion gave an average requirement of 0.45 Gm. of calcium and 0.88 Gm. of phosphorus per man per day. These figures, it must be remembered, represent only a minimum requirement, with no excess or margin for safety. Sherman therefore advised an increase of 50 per cent above actual requirement, making totals of 0.68 Gm. of calcium and 1.32 Gm. of phosphorus.

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[2] Sherman, H. C.: Chemistry of Food and Nutrition, New York, Macmillan, 1946.

The Food and Nutrition Board of the National Research Council, after reviewing more recent findings, recommends 0.8 Gm. of calcium per day for an adult man or woman and more for children (see Chap. 11).[3] No recommended allowances were set up for phosphorus because it can generally be assumed that the intake of this mineral is adequate when the calcium from natural foods meets the recommended levels.

Requirements During Pregnancy and Lactation. Calcification of the skeleton of the fetus takes place chiefly during the last three months of pregnancy, and obviously this is the period when the calcium requirement of the pregnant mother is the greatest. Even so, an infant is born calcium-poor and the lactating mother must supply relatively more calcium to her infant through the mammary gland than she did prenatally. It is more difficult to maintain a calcium equilibrium during lactation than during pregnancy. The allowance recommended by the Food and Nutrition Board of 1.5 Gm. of calcium during pregnancy and 2 Gm. during lactation takes the preceding facts into account.

Less is known about the exact phosphorus requirement during pregnancy and lactation, but it is assumed to run about 25 per cent higher than the calcium requirement. A sufficient intake of vitamin D (400-800 I.U.) is recommended to ensure normal absorption and utilization of both calcium and phosphorus.

Requirements During Growth. Growth of bone requires the storage of new calcium and phosphorus as well as replacement. Thus the calcium and the phosphorus requirements of infants and children must include allowance for maintenance and for growth. The growth requirement varies with age, being highest in relation to weight in the infant, lower and fairly constant after the first year and until puberty, when there is a sharp rise again during the period of rapid growth.

The Food and Nutrition Board allowances for calcium for the different age and sex categories reflect these specific needs. For no other factor is the total requirement for children of all ages greater than it is for the adult.

A careful selection of foodstuffs rich in calcium and phosphorus is necessary to meet these needs. For infants, the intake requirements may well be stated in terms of the amount of milk, since this is the chief food source. For older children, the requirements for calcium and phosphorus are most easily met by including a quart of milk a day, or its equivalent in milk products. The calcium and the phosphorus content of milk is not only high but in good proportion, and these factors are more readily available from milk than from most other foods.[4]

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[3] Recommended Dietary Allowances, National Research Council, Reprint and Circular Series No. 122, Washington, Aug., 1945.

[4] Shohl, A. T.: *Op. cit.*

During all periods of growth vitamin D or sunshine is essential for the most efficient absorption and utilization of these two minerals, but vitamin D can function only when calcium and phosphorus are present in reasonably adequate amounts (see Chap. 8).

Food Sources of Calcium and Phosphorus. Milk and milk products are the most important sources of readily available calcium. Most green, leafy vegetables contain calcium salts varying according to type and soil where grown. There is also a wide range in the availability of the calcium from green leaves, depending upon the amount of oxalic acid present. With it the calcium forms insoluble salts. In most sections of the country greens are not used regularly enough, nor in sufficient quantity, to be relied upon to replace milk, but they are important when milk is scarce or unobtainable. From Figure 12 it is apparent that relatively few foods are rich sources of calcium. It is possible to

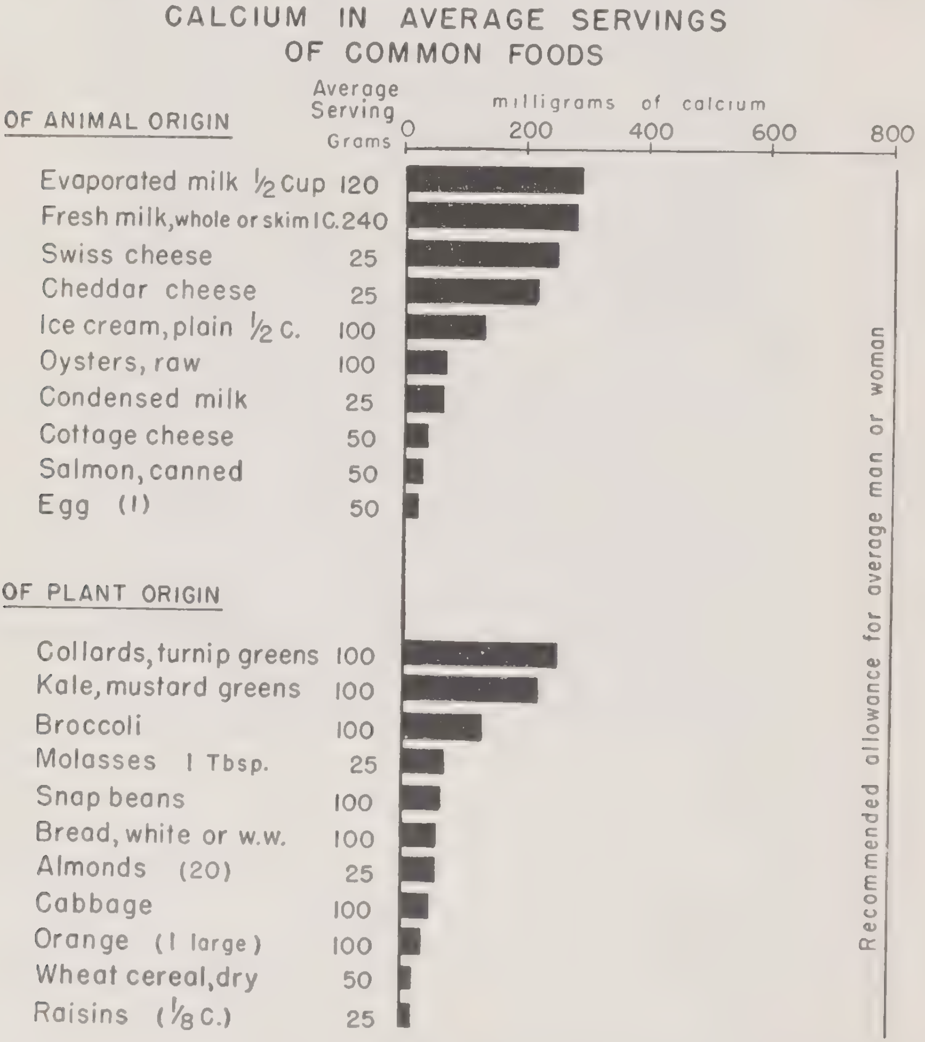
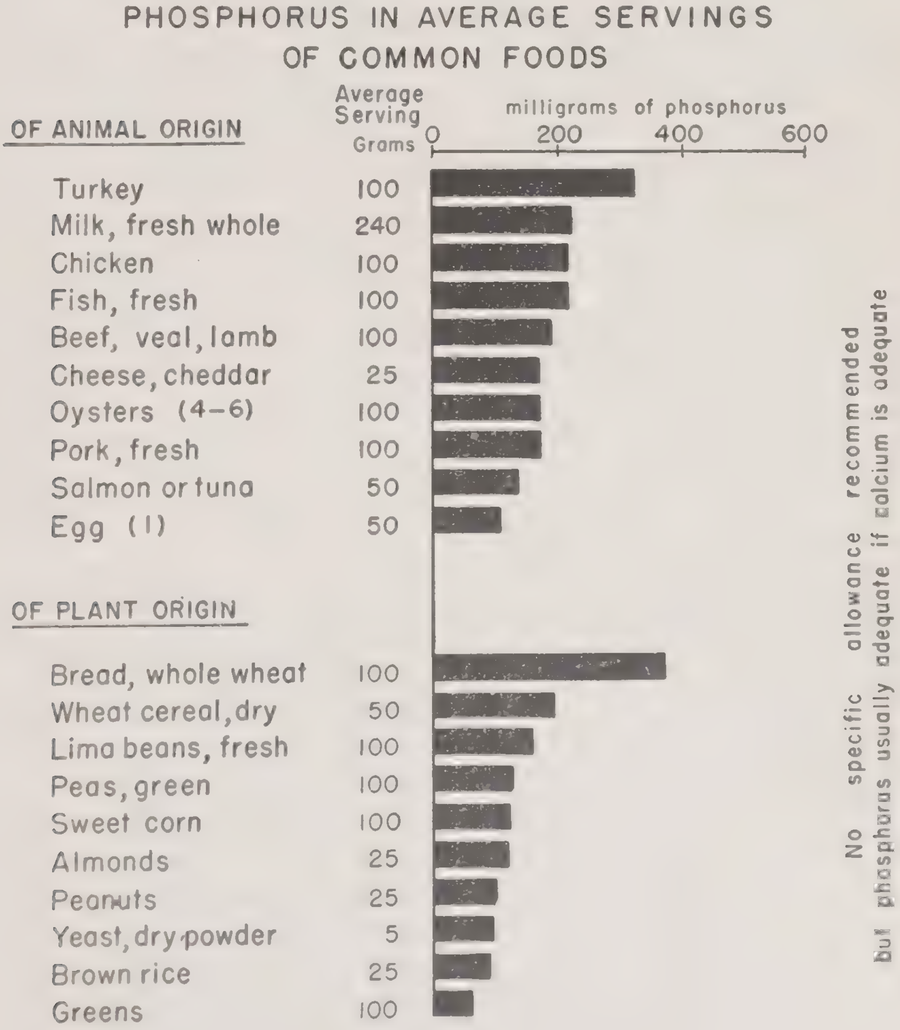


Fig. 12.

meet the calcium requirement, even on a low caloric intake, if foods are well chosen. The calcium contribution of a basic dietary pattern providing about 1,500 calories is shown on page 63.

Phosphorus is more widely distributed and less likely to be deficient in the average diet than calcium. Poultry, fish, meats, cereals, nuts and legumes, as well as milk and milk products, are all good sources. Although calcium and phosphorus are usually associated because they function together in the body, they are not always found in the same foods (see Fig. 13).

There may be slight losses of calcium and phosphorus in the cooking of vegetables, especially if the cooking water is discarded. There are wide differences in mineral content of plants grown on different soils. Thus foods should be chosen with a view to supplying an excess of these ele-



PHOSPHORUS IN AVERAGE SERVINGS OF COMMON FOODS

FIG. 13.

ments and thus providing a liberal margin of safety. This excess should be as great as in the case of protein, if not greater, because of larger losses in cooking and in digestion. For the child a quart of milk a day, together with other foods suitable for his age, provides such a margin of safety.

IRON

Blood Building. Iron is another mineral that is apt to be low in certain types of American diets, although comparatively small amounts are needed. There are less than five grams of iron in the body of a full-grown healthy person, but its importance to our well-being is strikingly out of proportion to the quantitative figures. Iron is a necessary constituent of hemoglobin, the coloring matter of the red blood cells, and is an essential constituent of every cell in the body. Very little is known regarding the function of iron in relation to chromatin, the pigment compound in the cells; but as a constituent of hemoglobin it is vitally essential to the processes of nutrition. Hemoglobin is a compound of protein, iron and a pigment complex. Hemoglobin combines with oxygen in the lung capillaries to form oxyhemoglobin and as such travels in the blood stream to the tissues, where the oxygen is released to take part in oxidative processes. Part of the carbon dioxide formed is carried back by the same hemoglobin, which drops its load in the lungs and starts out with a new load of oxygen.

Therefore, it is highly important that the food contain sufficient amounts of iron along with other necessary elements needed for its utilization. The iron of our bodies is used very efficiently. It is probably not used up or destroyed when it becomes a constituent of hemoglobin but is conserved and can be utilized again and again. Resynthesis of hemoglobin is presumed to take place in liver or bone marrow. Small amounts of both unabsorbed and metabolized iron may be lost in the stools; very little is excreted in the urine. A shortage of iron may cause anemia if the deficiency occurs when there is increased need for iron, such as in growth, pregnancy or blood loss. This increased demand may be normal, as in the first two instances, or abnormal due to hemorrhage.

Iron Copper Relationship in Hemoglobin Synthesis. During the last 25 years research along these lines has quite revolutionized our concepts regarding the most available forms of iron for animal and human nutrition. It was formerly maintained that the only available forms of iron were the complex organic compounds found in foods, with little realization that much of the iron in foods was really inorganic in nature. It was conceded by some physiologists that inorganic iron used in medicines might be absorbed to some extent, but could probably be utilized to a limited extent only.

More recent research has disclosed numerous ramifications to the problem of hemoglobin synthesis in the animal body. With carefully controlled animal experiments, it became apparent that even foods rich in iron might vary widely in their efficacy as blood regenerators, and suggestions were offered that these variations might be due to differences in the organic iron complex, to the solubility of the iron, or to other substances functioning in the utilization of iron. When it was found that the ash of certain natural foods functioned in the absence of organic factors, the logical transfer of emphasis was to a study of inorganic iron salts. When these in turn showed irregular results, attention was given to the possible significance of impurities. This hypothesis led to the interesting discovery[5] by the Wisconsin group, and later confirmed by other workers, that traces of copper greatly stimulated the utilization of iron for hemoglobin synthesis.

Available Iron. It has been shown more recently that there is a marked difference in the availability of iron derived from various food sources. For instance, only about half the iron in whole cereals is in usable form, and even less in certain green leaves. This marked variation in availability may account for some conflicting reports of earlier work. It now seems logical to assume that some anemias may be due to poor utilization of iron or an inability to synthesize hemoglobin. There is some evidence that vitamins A and C may perform functions related to this synthesis, and thus a deficiency of either of these factors may cause or aggravate an anemic condition.

It is impossible to tabulate available iron in foods at present, but work in progress is yielding quantitative data from animal and human experiments on the availability of iron from various sources and on other factors that may control the rate of hemoglobin synthesis.

Dietary Requirements. Allowance of from 10 to 15 mg. of iron has been suggested for adults. As a result of more recent studies, the standard of 12 mg. for adults has been suggested by the Food and Nutrition Board of the National Research Council.[6] This amount is probably more liberal than is necessary for men according to the most recent theories of iron metabolism mentioned earlier. According to Johnston,[7] "Iron metabolism is largely an endogenous process and very little new iron enters the picture each day. This theory, now accepted, necessitates a re-examination of our ideas of iron requirement." On the basis of Johnston's findings confirmed by other laboratories the Food and Nutrition Board add the following footnote to the 1945 revision: "There is evidence that the male adult needs little or no iron. The requirement will be provided if the diet is satisfactory in other respects."

During the period of rapid growth when an increase in red cells and hemoglobin is taking place, provision for new material as well as replacement requires a more liberal supply of iron. The anemias of infancy and childhood are evidence of the shortage that frequently occurs, although nature seems to have made provision for the period of nursing. Milk is essentially low in iron, but a reserve of this mineral stored in the liver of the infant during prenatal life is drawn upon during the nursing period and economically conserved for repeated utilization. The potential shortage of iron that might occur by the sixth or the seventh month may be forestalled by the early use of egg yolks, vegetable purées and other suitable sources of iron.

Menstruation and pregnancy both involve the production of more blood and consequently increase the demand for iron. Chlorosis or adolescent anemia in girls may be due to a low reserve of iron, or of other factors necessary for blood building, when menstruation begins. Languor and exhaustion result from the lack of an oxygen supply to the tissues, in turn due to a lack of the transporting substance, hemoglobin, which cannot be produced without a sufficiency of the important constituent, iron.

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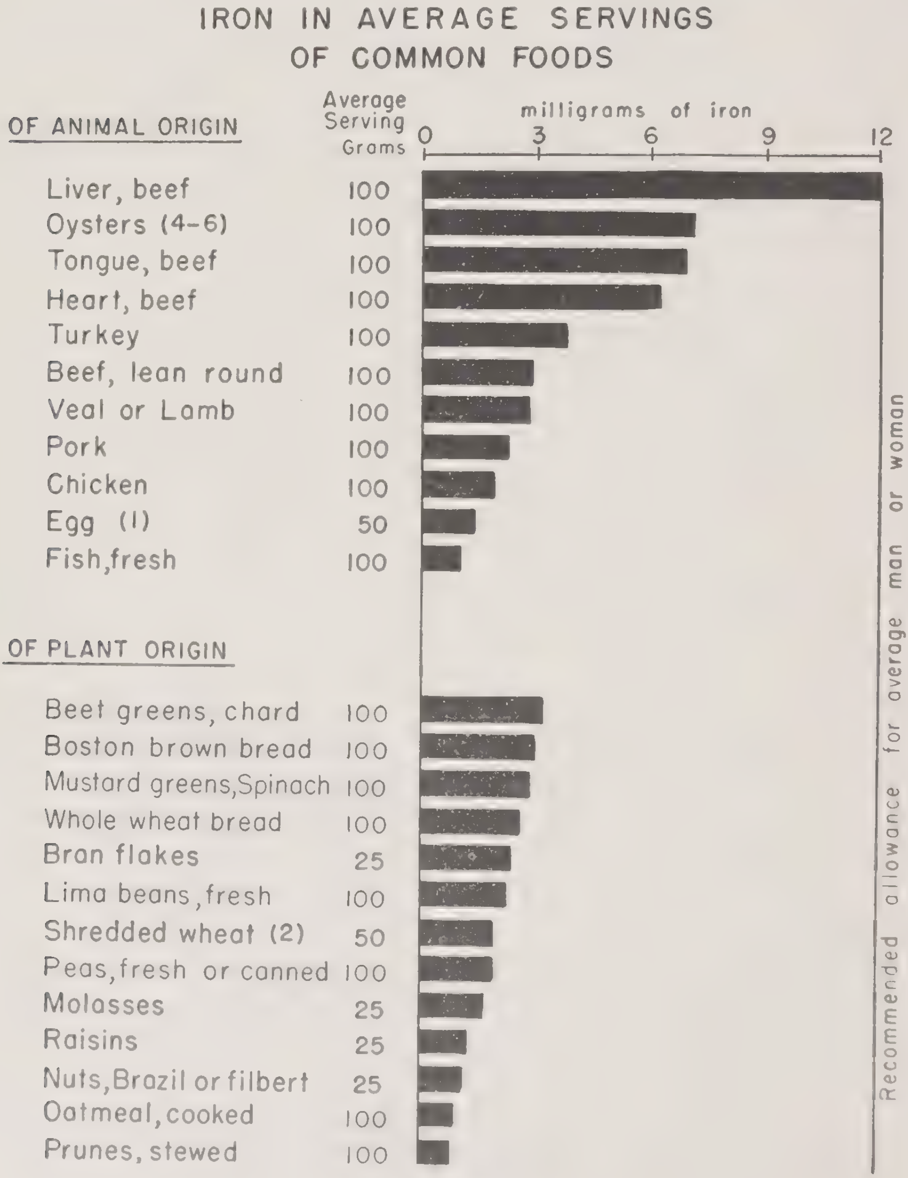
[5] Hart, E. B., *et al.*: J. Biol. Chem. **77**:797, 1928.

[6] Recommended Dietary Allowances, National Research Council, Reprint and Circular Series No. 122, Washington, Aug., 1945.

[7] Johnston, F. A.: J. Am. Dietet. A. **19**:838, 1943.

Food Sources. The richest sources of iron from animal and plant products are given in the accompanying chart. On the basis of average servings, liver, meats from other organs and oysters are the richest animal sources; and green, leafy vegetables



IRON IN AVERAGE SERVINGS OF COMMON FOODS

FIG. 14.

top the list of plant sources. Such foods as molasses, nuts and raisins, popularly featured as food sources of iron, are rich on a percentage basis, but small servings of these foods used infrequently do not constitute as important a source of food iron as some staple foods, such as whole grain or enriched breads and cereals. The iron content of all common foods is given in Table 1, Part Four. It will be observed that foods poor in iron have a noticeable lack of pigment, which is significant, since iron salts are all colored and usually lend color to a food rich in this element. Compare, for instance, egg yolk with egg white, molasses with white sugar, whole with milled grains and spinach with celery. With a few exceptions, such as the potato, it may be helpful to remember that white foods are not good builders of red blood.

The basic dietary pattern for one person, as outlined in Chapter 2, provides an ample amount of both calcium and iron, well above recommended allowances.

IODINE

Iodine has been found to be a normal constituent of the thyroid gland in man and in animals, and must be supplied continually if that gland is to function properly. The minute amount present in the body, calculated to be about 25 mg., and the relatively smaller quantities found in most foods made the detection and the measuring of this factor an extremely difficult problem. However, modern methods of analysis have demonstrated the relatively greater quantity of iodine that occurs in seaweed, in sea foods and in the water supply and the vegetables grown in nongoitrous regions. Conversely, the same thing is true: the water supply and the vegetables grown in goitrous regions are usually poor in iodine. This deficiency is characteristic of the soil of the Great Lakes region as far

Food for One Day	Measure	Approximate Calcium Gm.	Contribution Iron mg.
Milk or its equivalent	1 pint, 480 Gm.	.56	0.5
Meat, poultry or fish, cooked	1 serving, 100 Gm.	.01	4.1
Egg (1)	50 Gm.	.03	1.4
One additional protein food *	1 serving	.13	0.8
Fruit, fresh, canned or frozen, 1 citrus	2 servings, 200 Gm.	.03	1.0
Vegetables	3 servings		
1 green or yellow	100 Gm.	.04	0.4
1 other	100 Gm.	.08	2.0
potato	100 Gm.	.01	0.7
Bread, whole grain or enriched	3 slices, 90 Gm.	.05	2.3
Cereal, whole-grain or fortified	1 serving, 20 Gm.	.01	0.6
Butter or margarine	3 pats, 30 Gm.	.01	0.1
Total		.96	13.9
Recommended allowances for sedentary man or woman		.80	12.0

* Calculated as an average of meat, cheese, egg and milk.

south as West Virginia and of some sections of the Pacific Northwest.

Iodine and Goiter. Preceding this survey of the iodine content of soil it had been noted that the disease of common goiter was unevenly distributed over the United States, and that it seemed to be most prevalent in the very regions where there was the least iodine. This early suspicion has been confirmed, and we now recognize that common goiter is primarily an iodine-deficiency disease. The thyroid gland becomes enlarged owing to the overgrowth of the structural tissue, but there is a decrease in the actively secreting tissue and the whole organism suffers from the lack of this internal secretion. The incidence of common goiter is higher in females than in males, and is most apt to appear during adolescence or pregnancy.

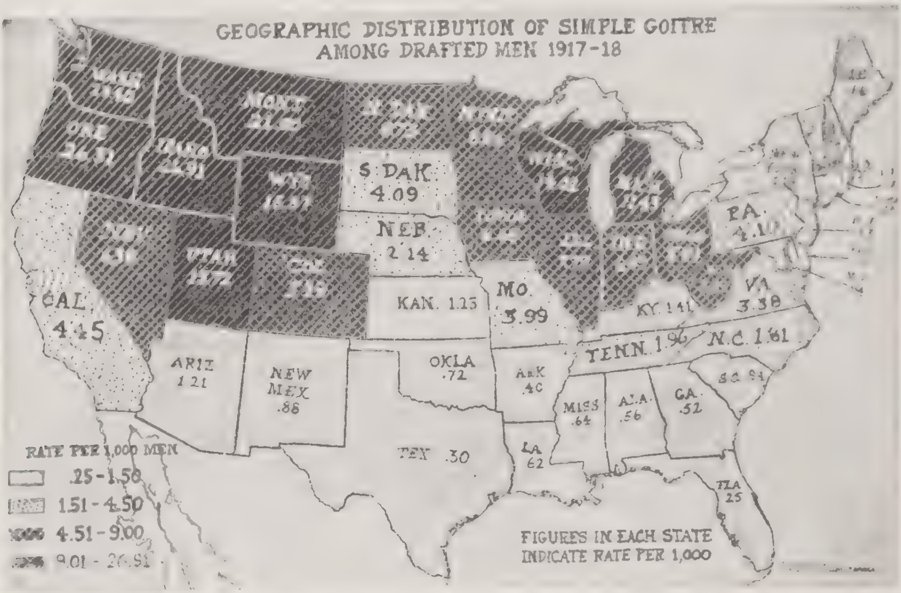


Fig. 15. Geographic distribution of simple goiter among men drafted for World War I. These goitrous areas are naturally low in iodine. (U. S. Dept. Public Health.)

Goiter Prophylaxis. The suggestion was made by Marine and Kimball that iodine might be administered to children in goitrous regions as a preventive measure. Consequently, as an experiment, iodine was administered to school children in Akron, Ohio, with remarkably successful results. By a similar project in three cantons in Switzerland the incidence of goiter was diminished during three years from 87 to 13 per cent. These demonstrations suffice to show that although the body requirements for iodine are exceedingly small, they must be met in order to prevent goiter. Many sections of the country, notably the east coast and the southern states, as well as California on the west coast, need pay little attention to this factor because iodine is indigenous. However, in the goitrous regions this was a problem requiring attention and Michigan led the way in its solution by promoting education in goiter therapy as a public-health measure.

The method of administering iodine where it is not present in foods grown locally presents a real problem. To put it in a community water supply, where only a small proportion of the total amount is actually used for drinking, is expensive. Such a method fails to reach the rural population, among whom goiter is just as prevalent as among city dwellers. The use of chocolate-coated iodine tablets, which has been tried in schools, has proven satisfactory; but even with an extensive educational program the mothers and the preschool children cannot be reached easily. The most satisfactory way is to include a small percentage of iodine in common table salt to be marketed in goitrous regions and then educate the people to use the iodized salt. This plan was adopted by Michigan in 1924, and all salt manufacturers in the state put on the market a table salt containing 0.02 per cent sodium iodide. Eleven years later the results of this plan adopted by the Michigan Department of Health far exceeded the hopes of those who instigated it. The incidence of endemic goiter or enlarged thyroid has been reduced almost to nil.[8] The decrease in the sale of iodized salt that has occurred since publicity on the subject has fallen off is paralleled by a slight increase in the number of goiters in school children. The discontinuance of iodized salt in one county in Michigan was followed by a marked rise in the incidence of goiter within three years. The incidence of goiter in the public schools of Detroit from 1924 to 1935 is a striking illustration of what health education can accomplish (Fig. 16). In other states, where the use of iodized salt has not been encouraged, the incidence of thyroid enlargement has remained fairly constant over the same period of years.

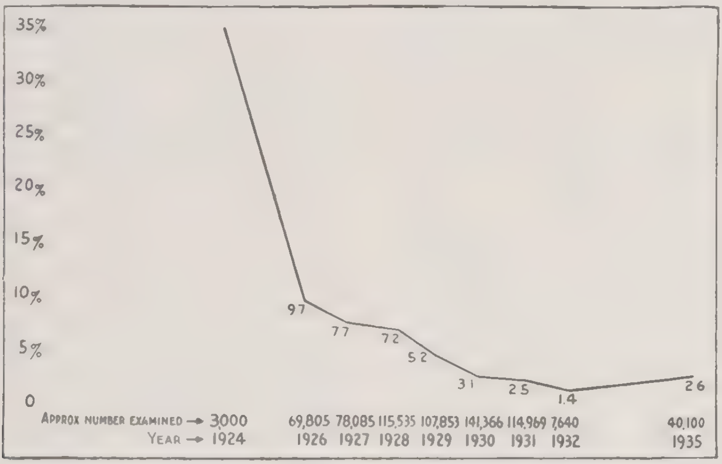


Fig. 16. Graph illustrating the incidence of goiter in the public schools of Detroit from 1924 to 1935. (Kimball, O. P.: J.A.M.A. **108**:860.)

In 1941, the National Study Committee on Endemic Goiter resolved that the content of potassium iodide in table salt and in salt for domestic animals should be 0.01 per cent, provided a suitable stabilizer was used. This amount was calculated from per-capita consumption of salt to be sufficient for the prevention of endemic goiter and not great enough to cause harmful effects in other types of thyroid disorders. In an excellent review article bringing the subject of goiter prophylaxis up to date, Kimball[9] recommends that iodized salt be put on the market for the entire country and that the term iodized be omitted because it tends to scare some people.

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[8] McClure, R. D.: J.A.M.A. **109**:783, 1937.

SODIUM, POTASSIUM, MAGNESIUM, SULFUR AND CHLORINE

Of the body minerals mentioned, sodium, potassium, magnesium, sulfur and chlorine are usually present in abundance in the average diet and do not need further discussion from that point of view.

Sodium chloride, common table salt, plays a regulatory role in the body metabolism, both the sodium and the chlorine performing specific functions. Animal foods probably contain enough sodium chloride for our actual needs, but with plant foods we seem to need a moderate amount of sodium chloride, just as do the herbivorous animals, who are known to seek the "salt licks." This craving is due to the large amount of potassium which is present in plant tissue and which needs sodium to balance it in the functioning of animal cells. In certain pathologic states this need is exaggerated. When hard work is performed in a high-temperature environment, excessive perspiration may lead to salt depletion accompanied by "heat cramps." Many industrial plants are now preventing this condition by providing for all employees water with about 0.1 per cent solution of salt or "salt tablets" to be taken with a liberal amount of water. The significance of the salt as a stimulant to thirst, thus preventing dehydration, may be even greater than the role of salt *per se*. In any case, reduction of "heat fatigue" is reported as a result of more salt and water.

Sodium, potassium and magnesium salts in solution in the blood and the lymph are chiefly responsible for maintaining the osmotic pressure relations between cells and the surrounding fluids. The nice balance that is ordinarily maintained in the body may be locally disturbed when bathing in fresh water, as shown by the irritating effects on the delicate nasal membranes. However, a salt solution of a concentration similar to that of our tissue fluids is not irritating. Such a solution of 0.85 per cent sodium chloride in distilled water is known as physiologic saline and is useful for gargles, washes or enemas. Sodium and potassium also play an extremely important role in the maintenance of neutrality in the body tissues. This will be discussed later.

Magnesium is relatively abundant in muscle and in bone tissue, but its function is not well understood. It probably acts with other minerals as a regulator and as a constituent of certain muscle enzymes. It forms an integral part of the complex bone salts. It is closely related to calcium in its functioning, but it cannot replace it in the tissues. The interrelationships of calcium, phosphorus and magnesium are complex, and a disturbance in the normal balance may result from or cause pathologic conditions.

Magnesium is sufficiently well distributed both in plant and in animal foods to ensure an adequate intake, so that special attention does not have to be given to it. It occurs in quantities comparable with those of calcium

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[9] Kimball, O. P.: J.A.M.A. **130**:80, 1946.

Sulfur is most often found in combination with protein, being a constituent of three amino acids. Glutathione, a compound of three amino acids, one of which contains sulphur, is essential to all cell metabolism. It acts as a coenzyme in oxidation-reduction reactions, which is a major type of chemical change taking place in cell metabolism (see Chap. 10).

Some food proteins are richer in sulfur than others, but the supply in the average diet is apt to be sufficient if the protein is adequate in quality and in quantity.

TRACE ELEMENTS

Many inorganic elements occur in animal tissues in extremely small quantities, and in some instances are detected only by spectrographic methods or by the use of radioactive elements. These are known as trace elements because they are found only in traces. However, this does not mean that they are unimportant; for it is now known that some of them are absolutely essential, while the functions of others are less well understood. Some of the more important trace elements, such as copper and iodine, have already been discussed.

Essential Trace Elements. The trace elements cobalt, fluorine, manganese and zinc are recognized as essential to animal health.[10] Copper and iodine may also be considered in this class.

Cobalt seems to function with iron and copper in the formation of red blood cells. An overdose experimentally has been shown to produce polycythemia, i.e., red cells in excess of normal. There is ample cobalt present in the average diet, and there is no danger of an excess from natural foods.

Fluorine has long been recognized as a normal constituent of bones and teeth, the dental enamel being especially rich in this element. The fluorine content of surface soils and water supplies varies widely, and naturally influences the fluorine content of food grown in the region and, in turn, the level of human consumption.

Excess fluorine is now recognized as the cause of mottled enamel in the permanent teeth of children in certain areas all over the world. This condition is endemic in the United States, especially in Texas and adjacent areas. This mottling occurs when fluorine is present in the drinking water in concentrations of 1.5 p.p.m. (parts per million) or more. In these same areas the low incidence of dental caries attracted comment. More recently the relation of traces of fluorine in local water supplies to the low incidence of dental caries has been studied extensively.[11] The question of finding a level of fluorine in drinking water low enough to eliminate mottled enamel, but high enough to reduce the incidence of dental caries, had to be answered. It is now estimated that 1 p.p.m. is about the critical level, and if this amount could be assured in any community a reduction of from 50 to 60 per cent in dental caries could be anticipated. Topical application of fluorides directly to the teeth is reported to have reduced dental caries by 40 per cent, but data on this type of therapy are meager. Large-scale experiments now in progress in several communities will point the way for effective use of fluorine prophylaxis. Mass control of dental caries is indeed a possibility in the future.

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[10] Shohl, A. T.: *Op. cit.*

[11] Symposium: Postwar implications of fluorine and dental health, Am. J. Pub. Health **34**:133-147, 239-249, 1944.

Manganese plays essential roles both in plant and in animal metabolism. It occurs in all human tissues, but seems to function specifically in blood formation and in certain endocrine glands. The manganese requirement of man is not known, but the average diet probably supplies enough. Blueberries and wheat bran are the richest known sources; nuts come next. The manganese content of plants is dependent upon soil content.

Zinc occurs in animal and in plant tissues in amounts comparable with those of iron, but its function in human nutrition is unknown. There is still some question as to whether it is an essential element, but there is satisfactory evidence that it is nontoxic in amounts usually ingested in food.

Trace Elements of Doubtful Significance. No one has yet been able to demonstrate that aluminum, arsenic, bromine, nickel and silicon are essential to animal life. However, all are found in traces both in animal and in plant tissues. They appear to be harmless in the amounts and the forms found in natural foods. Contrary to an earlier popular concept, traces of aluminum from cooking utensils or in baking powders are harmless. These elements are all ingested with foods—possibly as contaminants—and are excreted largely in the stools.

Arsenic is found in sea foods and in the human body. It accumulates in hair and in nails, but its biologic function is not understood. It has been used therapeutically since the Middle Ages. Overdoses cause gastro-intestinal disturbances, but there is no danger of an excess from natural foods.

Toxic Trace Elements. Selenium and fluorine (the latter discussed previously) are the only mineral elements commonly found in food or drinking water in concentrations detrimental to human or animal health. In certain areas in the western part of the United States selenium occurs in locally grown feeds in sufficient concentrations to cause an animal disease called blind staggers. It was formerly known as alkali disease, but it is now recognized as due to an excess of selenium. So far as has been reported, this mineral is not a menace to human health. (For lead poisoning see Chap. 32.)

ACID-BASE BALANCE

A discussion of minerals would not be complete without consideration of the acid and the basic elements in food and their relation to the maintenance of neutrality of the blood. The more important basic elements—sodium, potassium, magnesium and calcium—react with the acid elements—chlorine, sulfur and phosphorus—or with organic acids to form salts that occur in natural foods. When these foodstuffs are oxidized or burned in the human body, they yield either an acid or a basic ash, according to whether the acid or the basic elements predominate in the foods eaten. Most fruits contain organic acids combined with basic elements. When such compounds are oxidized in the body, they leave an alkaline ash. Some other foods, such as cereals and meats not at all acid in taste, yield end products that are strongly acid. Thus by potential acidity or alkalinity of foods is meant the reaction that they will ultimately yield after being oxidized in the body.

Several workers have calculated quantitatively the excess of either acid or base as cubic centimeters of normal acid or base per 100 Gm. of edible food. These figures are referred to as degree of acidity or alkalinity. There is a difference of opinion as to the accuracy and the significance of such quantitative figures, but those commonly used are from Bridges and are listed as Table 5 in Part Four. Bridges also gives a "conventional classification" that is easy to remember and sufficient for general use.

Bridges[12] classifies foods into three groups as follows:

POTENTIAL ACID-BASE REACTION OF FOODS

Group 1 (Acid)

Meats, fish, poultry
Eggs, cheese
Nuts (filberts, peanuts, walnuts)
Cranberries, plums, prunes

Group 2 (Neutral)

Butter
Cream
Cooking fats
Starches
Sugars

Group 3 (Basic)

Fruits (except those named in Group 1)
Vegetables
Milk
Nuts (almonds, Brazils, chestnuts, coconut)

Acidosis and Alkalosis. In health the body is able to maintain the alkalinity of the blood with but slight variation from the normal range, regardless of the large amounts of acids formed in the body in the process of metabolism. This is due to the buffer substances in the blood, the protein and the alkaline salts. In certain abnormal states this mechanism may be impaired so that an excess of either alkaline or acid elements may predominate to the extent that the blood may become more or less alkaline than is normal. Acidosis is the scientific term applied to a lowered alkaline reserve, and alkalosis to a retention of excess of basic factors. In diseases complicated by acidosis a predominantly basic diet is indicated.

Normally, the reaction of urine reflects the potential reaction of the food eaten, because the excess of either acid or base will be eliminated by the kidneys. According to some authorities, when the reaction of the urine reaches extremes of acidity or alkalinity, some irritation of the kidney may result. A well-balanced diet will contribute both acid and basic elements as well as other factors necessary for good nutrition.

Conclusive evidence is as yet not available regarding the practical importance of the acid-base balance of foods in relation to health. Experience and scientific evidence indicate a wide range of adaptability on the part of the human body and do not support the "scare" propaganda with which certain food faddists promote the sale of "alkalizing" compounds to prevent acidosis.

REVIEW QUESTIONS

1. Ash or mineral elements make up less than 4 per cent of the human body. What two elements make up more than 60 per cent of the total ash?

2. Calcium and phosphorus are essential not only for bone building but for other less conspicuous functions. What are some of them? For what element is the recommended allowance for children of all ages as high as for adults?

3. Sodium, potassium and magnesium salts are essential in controlling

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[12] Bridges, M. A.: Dietetics for the Clinician, Philadelphia, Lea, 1941.

SUMMARY TABLE OF MINERAL ELEMENTS IN NUTRITION

(The information summarized here is given in more detail in the text.)

Element	Forms Occurring	Rich Sources	Dietary Allowance	Function in the Body	Elimination
Calcium	Org. and inorg.	Milk, cheese, green vegetables	Adult, .8 Gm. daily; child, 1.0 Gm. Low in average diet	Bone and tooth formation; coagulation of blood. Regulates heartbeat; aids in regulating mineral metabolism	Feces chiefly; some in urine
Phosphorus	Org. and inorg.	Milk, poultry, fish, meats, cheese, nuts, cereals, legumes	1.3 Gm. daily. Low in average diet	Bone and tooth formation; constituent of cells. Aids in utilization of organic foodstuffs and regulation of neutrality	Urine and feces
Iron	Org. and inorg.	Liver, meat, oysters, legumes, whole grains, green vegetables	12 mg. daily; more for anemic individuals	Constituent of hemoglobin, blood and tissue cells. Necessary for oxygen-carrying power	Feces
Iodine	Inorg.	Sea foods, water and plant life in nongoitrous regions; sodium iodide in iodized salt	Adequate in nongoitrous regions; adult, 0.15-0.30 mg.	Necessary for normal functioning of the thyroid gland	Urine
Sodium	Inorg. and org.	Common salt, sea foods, animal products	Adult, 3-6 Gm. Adequate in average diet	Regulates osmotic pressure, neutrality and heartbeat	Urine chiefly and perspiration
Potassium	Inorg. and org.	Cereals, vegetables, legumes	Adult, 2-4 Gm. Adequate in average diet	Constituent of all cells. Regulates osmotic pressure and neutrality	Urine chiefly and perspiration
Magnesium	Inorg. and org.	Nuts, cereals, legumes	Adequate in average diet	Antagonistic to calcium. Necessary for mineral balance in body	Feces chiefly; some in urine
Chlorine	Inorg.	Common salt, sea foods, animal products	Adequate in average diet	Constituent of acid in the gastric juice. Regulates osmotic pressure	Urine chiefly and perspiration
Sulfur	Org.	Protein foods	Adequate if protein is adequate	Necessary constituent of all body tissues—hair and nails especially	Urine
Copper	Inorg.	Liver, nuts, legumes, cereals, dried fruits	Adult, 1.0-2.0 mg.; child, 0.05 mg. per kilo.	Aids in utilization of iron in hemoglobin synthesis	Feces chiefly

osmotic-pressure relations. Why is this important? What happens when fresh water is brought into contact with the mucous membranes in the nose?

4. Milk and dairy products are among the most efficient food sources of calcium and phosphorus. How much milk does a child need to provide his daily calcium requirement?

5. Iron is essential for building the hemoglobin of the blood. What is the function of hemoglobin? What factors other than iron are necessary for hemoglobin synthesis?

6. Iron, both organic and inorganic, occurs in common foods, but the availability for hemoglobin synthesis seems to depend upon other factors. What are they? What is the function of copper? Is it specific?

7. Iodine is necessary for the normal functioning of the thyroid gland. In what localities of the United States is iodine deficient in the soil? Does this affect the iodine content of plants grown there?

8. There is evidence that the prophylactic administration of iodine has been effective in reducing the incidence of goiter. Where, when and how was this accomplished? What is the problem with regard to continuing the project?

9. There are at least eleven so-called trace elements. Which ones are essential for animals? Which may be detrimental to animals? Which ones are harmless but of doubtful significance?

10. The potential acid and alkaline elements in food help in the maintenance of acid-base equilibrium within the body. How does the reaction of the urine indicate the mechanism of maintaining this equilibrium?

11. Fruits and vegetables are potentially basic. Meats, fish, cereals and eggs are potentially acid. What happens in the body when both types of food are eaten at the same meal?

12. Certain foods are frequently recommended as good sources of specific minerals without considering other valuable contributions that they may make to the diet. List five foods rich in calcium and five foods rich in iron and give their complete percentage composition as indicated in the following tabular form. (See Table 1, Part Four.)

Food	Protein	Fat	Carb.	Cal.	Ca	P	Fe	Water	Fiber

8

Properties and Functions of the Vitamins

Chapter Topics

- GENERAL DISCUSSION OF VITAMINS
- FAT-SOLUBLE VITAMINS
  - VITAMIN A AND PRECURSORS
  - VITAMIN D (CALCIFEROL)
  - VITAMIN E (TOCOPHEROL)
  - VITAMIN K (MENADIONE)
- WATER-SOLUBLE VITAMINS
  - ASCORBIC ACID (VITAMIN C)
  - VITAMIN B COMPLEX
  - THIAMINE (VITAMIN B_1)
  - RIBOFLAVIN (VITAMIN B_2)
  - NIACIN (NICOTINIC ACID)
- WATER-SOLUBLE VITAMINS (CONT.)
  - PANTOTHENIC ACID
  - PYRIDOXINE (VITAMIN B_6)
  - BIOTIN
  - PARA-AMINOBENZOIC ACID
  - INOSITOL
  - CHOLINE
  - FOLIC ACID
  - OTHER FRACTIONS OF THE VITAMIN B COMPLEX
  - OTHER VITAMINS

The first decade of the twentieth century marked a great advance in the study of foods and nutrition when Hopkins of England and Funk of Germany proposed the theory, based on previous observations, that animal life could not be supported by mixtures of pure proteins, fats, carbohydrates and minerals. They observed that the animal body was adjusted to live either on plant tissues or on other animals, and that these natural foods furnished substances other than the basal constituents mentioned above.

GENERAL DISCUSSION OF VITAMINS

Vitamins are necessary dietary constituents that perform specific and vital functions in the cells and the tissues of the body. Each vitamin is a separate chemical entity with characteristic properties; each demands individual consideration. The rapid progress today in the field of vitamin research is producing such a volume of scientific literature that it is almost impossible to keep up to date. This chapter is merely a brief résumé of generally accepted facts or theories regarding the function of each vitamin in normal nutrition, usable information regarding the chemistry, properties and assay methods and distribution in common foods and food concentrates. Deficiency diseases, their symptoms and dietary treatment are discussed in Chapter 22. It is recommended that the two chapters be studied together.

The term vitamine, meaning a vital amine, was proposed by Funk in 1911 to designate a new food constituent necessary for life which he thought he had identified chemically. Other terminology was proposed as new factors were discovered, but the word vitamin, with the final e dropped to avoid any chemical significance, met with popular favor. It is now applied to a whole group of substances that vary widely in chemical composition and in physiologic significance. According to Oser,[1] "a vitamin may be defined as an extremely potent organic compound which occurs in minute quantities in natural foodstuffs, and must be available to the body from dietary or other sources in order that a specific function of physiologic maintenance or growth may proceed normally." Oser's definition might also apply to essential amino acids or other organic compounds since identified as necessary for the functioning of living tissue, but the term vitamin is applied to a limited number of these factors not otherwise classified. There is really very little justification for having these constituents of foods bear the common name vitamins—they differ from each other in physiologic function, in chemical structure and in natural distribution—but the term vitamin is apparently here to stay.

History. Each of the vitamins was first discovered by observations on man or animals or, as one writer has expressed it, "vitamins are recognized biologically by their absence rather than by their presence." The disease, or pathologic state, recognized as due to a specific deficiency and cured by certain foods, later found to contain that missing something, led to the naming of vitamins according to curative properties. Present opinion favors a name descriptive of the substance and not of its physiologic properties. The history of the recognition of deficiency diseases and the discovery of vitamins are among the best scientific stories of our era and worthy of popular dramatization. Space does not permit of a recital of the historical development here, but the student will enjoy reading the accounts in Rose[2] and in McCollum *et al.*[3]

Vitamin Groups. Whenever a supposedly single vitamin has proved to have more than one physiologically active fraction, the term complex has been used after the vitamin letter to indicate this multiple nature. Even after the fractions are separately identified they may still be referred to collectively as a group (vitamin B complex). As the chemical structure of each vitamin is discovered it is named appropriately if it is not already a recognized compound. However, the lettered nomenclature may still be used to some extent, especially in popular discussions of the subject. From time to time new vitamins are postulated but are added to the accepted list only after extensive research.

It is sometimes convenient to group the vitamins according to solubility. Vitamins A, D, E and K are fat-soluble. Two water-soluble groups are recognized—those related to vitamin C as found in citrus fruits and those associated with the vitamin B complex as found in yeast and liver extracts. Vitamin F was omitted from the vitamin family owing to a misunderstanding: a commercial application of the term to certain essential fatty acids led to confusion for a time, but the term has now been dropped.

Vitamin Units and Assay Methods. Feeding tests on animals at first of-

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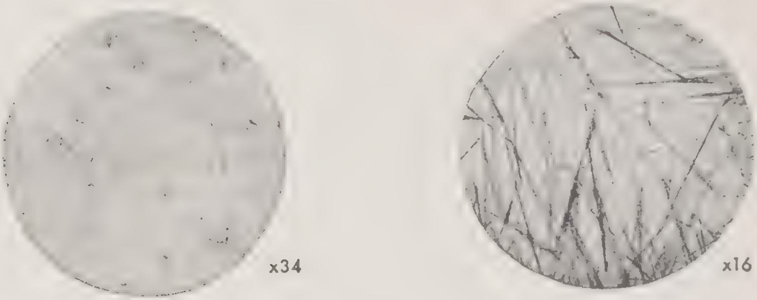
[1] Hawk & Bergeim: Practical Physiological Chemistry, Philadelphia, Blakiston, 1937.

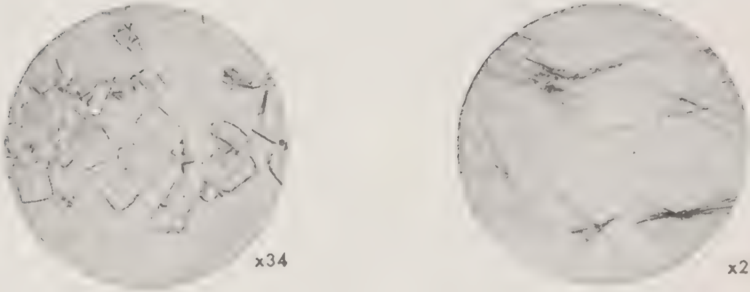
[2] MacLeod and Taylor: Rose's Foundations of Nutrition, New York, Macmillan, 1944.

[3] McCollum, Orent-Keiles and Day: The Newer Knowledge of Nutrition, New York, Macmillan, 1939.



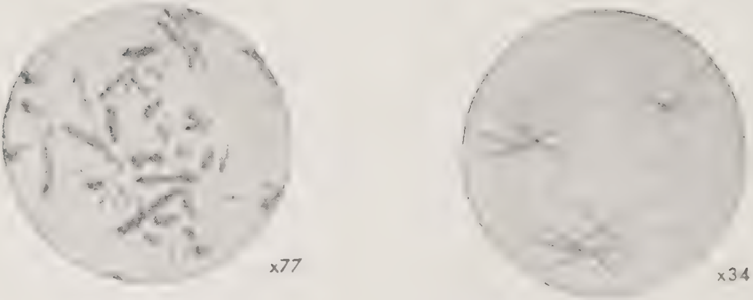
CALCIFEROL (VITAMIN D)

MENADIONE (VITAMIN K)



ASCORBIC ACID (VITAMIN C)

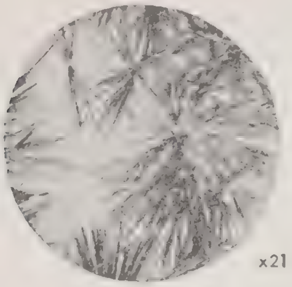
THIAMINE (VITAMIN B_1)



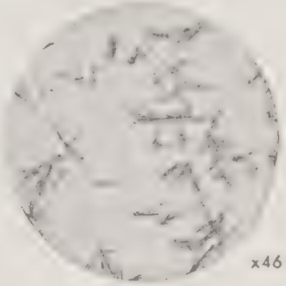
RIBOFLAVIN (VITAMIN B_2)

NICOTINIC ACID (NIACIN)

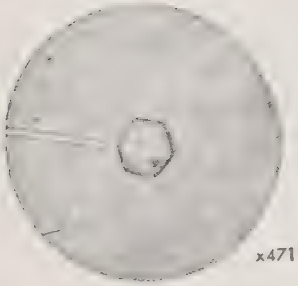
FIG. 17. Crystalline forms



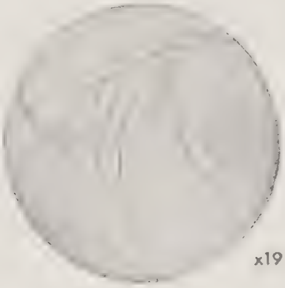
NICOTINAMIDE



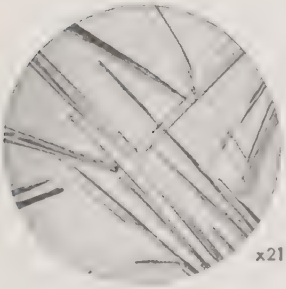
PYRIDOXINE



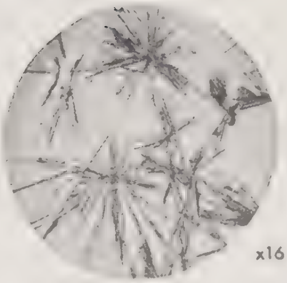
CALCIUM PANTOTHENATE



P-AMINOBENZOIC ACID



CHOLINE



INOSITOL

of the vitamins.

fered the only device for testing foods for their vitamin content. This type of procedure, called the bio-assay method, is still the basis of comparison for the standardization of newer chemical or microbiologic methods of assay. The earlier vitamin units were based upon the results of bio-assays and the units were expressed in terms of growth rate of experimental animals or protective or curative doses. As the efforts of chemists to concentrate, identify and synthesize each vitamin have succeeded, potency has then been expressed in metric weights of pure crystalline substances.

The only vitamin values still given in International Units (I.U.) and originally defined by a League of Nations committee are vitamins A and D. All others are given in milligrams (mg.) or micrograms (mcg.), whichever will avoid inconvenient decimals. Each of the units will be discussed in more detail and defined in sections devoted to the respective vitamins. (See also summary table at end of this chapter.)

Determination of the specific vitamin activity of natural foods becomes an increasingly difficult task as the number and the complexity of the vitamins increase. Many of the older figures have had to be discarded or carefully checked since improved and standardized methods have been developed. A true vitamin in the chemical sense may be formed in the plant or animal from a closely related compound, a precursor or provitamin. The bio-assay of foods detects all available vitamin activity, while a chemical method may detect only the preformed vitamin. Table 1, Part Four, gives the vitamin content of American foods in so far as they have been determined. Even though such a table has many discrepancies, it is much more reliable and satisfactory than the older qualitative estimates expressed by a number of plus signs. The losses of vitamins in cooking are discussed under Specific Foods in Part Three.

Human Requirements. A natural sequence to these more reliable figures for vitamins in foods has been the attempt to give quantitative estimates of human vitamin requirements. Obviously these estimates are only approximate, based as they are upon the work of various investigators using different methods of approach. Furthermore, there may be a wide margin between the requirement to protect against a deficiency disease and the requirement for optimum health. Thus, in the past, every textbook or article on the subject might offer different estimates of daily requirements.

Recommended dietary allowances of vitamins and other food essentials for different age and sex categories are discussed more fully in Chapter 11. These recommendations of the Food and Nutrition Board of the National Research Council were first announced at the National Nutrition Conference in Washington, May, 1941, as the "yardstick of good nutrition" and revised in 1945, and they represent the consensus of opinion of a large number of scientific authorities. The establishment of this "yardstick," which may be attained by a variety of dietary patterns, makes for a wider application of nutrition than was possible when a goal was expressed in terms of foods rather than of nutrients. For popular application the goals must still be interpreted into foods commonly used. It is recommended that the table given in Chapter 11 and the explanatory paragraphs be studied in connection with this chapter on vitamins.

Terminology. Before discussing the individual vitamins there are terms that may need explanation. The word avitaminosis means, literally, without vitamins, but it is generally used with a letter following (i.e., avitaminosis A) to indicate a specific and a complete deficiency of that factor. The word deficiency may be used to indicate varying degrees of shortage; thus mild, moderate, severe or complete. The possibility of an excess intake of certain vitamins has been postulated, and in one instance (vitamin D) a large excess has proved to be toxic. Such a condition is termed hypervitaminosis. Early symptoms of vitamin deficiencies so vague that they are rarely mentioned to a physician are called subclinical. Recent attempts have been made to develop satisfactory criteria for judging early deficiencies. These are discussed and listed in Chapter 22.

FAT-SOLUBLE VITAMINS

Vitamin A and Precursors

Physiologic Significance. Vitamin A was the first of the fat-soluble vitamins to be recognized. This happened in 1913 when two groups of workers discovered independently that rats failed to grow normally on diets lacking in natural fats. At about the time growth ceased, the eyes became inflamed and apparently infected. This characteristic eye disease, known as xerophthalmia, was relieved in a few days by the addition to the diet of a little butter fat or cod-liver oil. These fats contained the protective or curative factor later known as vitamin A and also called antiophthalmic.

More recent work has demonstrated that the eye is not the only organ affected when there is vitamin A deficiency. The mucous membranes lining the nose, the throat and other air passages, the alimentary and the genito-urinary tracts, show a change in the epithelial cells known as keratinization. Rough, dry and scaly skin, especially on the arms and thighs, is another indication of a vitamin A deficiency. Any of these symptoms may be due to an inability to metabolize carotene, i.e., convert it into true vitamin A, even though the carotene intake is adequate. Wherever these tissue changes occur, the natural mechanism for protection against bacteria or other foreign substances is impaired and the tissue may easily become infected. Young rats show a high susceptibility to eye infections; older rats more often develop lung or glandular infections. Some earlier clinical observations tended to confirm these experimental findings, namely, that a liberal supply of vitamin A might increase resistance to or decrease the severity of colds and sinus, gland and ear infections. From these findings came the term anti-infective. This was not entirely justified, because the function of this vitamin is really the maintenance of normal epithelial cells that naturally afford the best physiologic protection against bacterial invasion.

Vitamin A is essential to normal reproduction in rats, pigs and other animals. Studies have shown that for successful reproduction and lactation the diet must furnish more vitamin A than is needed for good growth. Female rats may on minimal adequate vitamin A intake show no outward signs of vitamin A deficiency yet they are not able to bear or rear vigorous young. With an outright deficiency there is an interference with the normal estrus cycle in the female and a testicular degeneration in the male rat. Sows deprived of adequate vitamin A may give birth to litters of pigs with defective eyes or without eyeballs. Renal or urinary calculi have been observed in rats deprived of vitamin A. The relationship in humans between vitamin A deficiency and formation of renal stones is controversial.

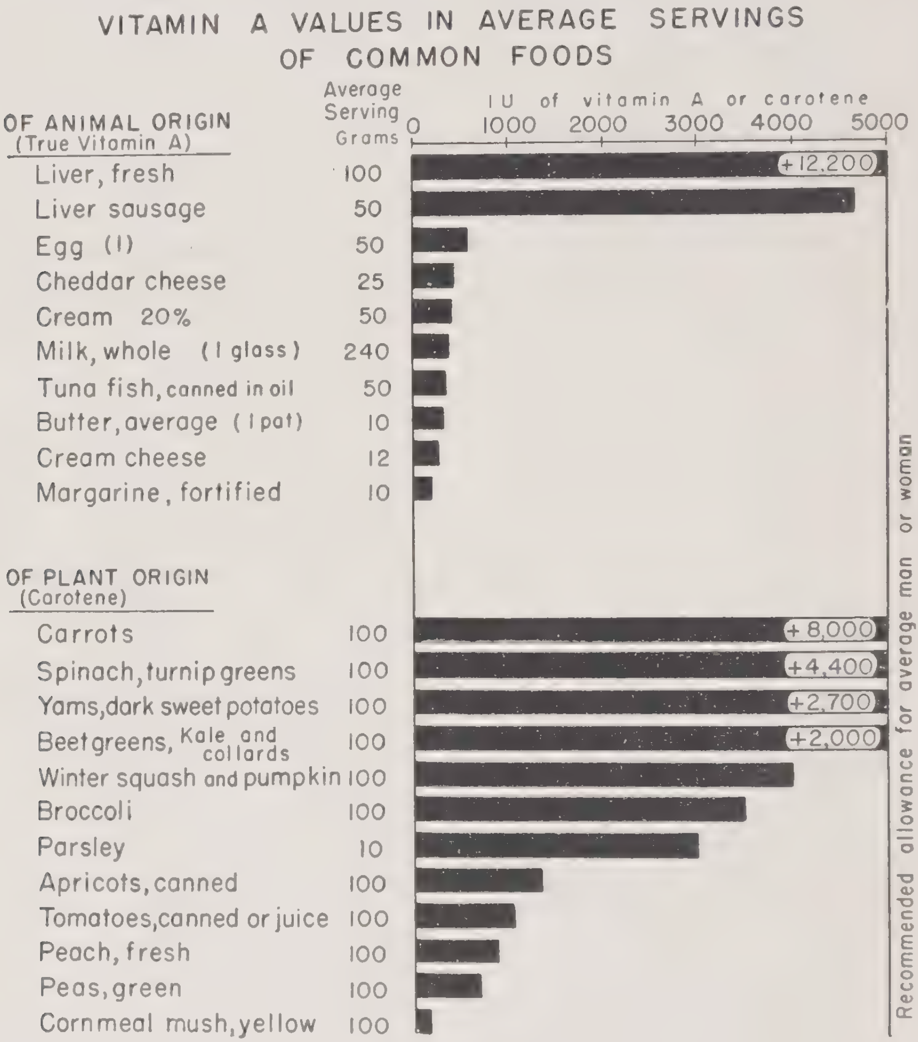


Fig. 18.

The earliest sign of vitamin A deficiency in man is a disturbance in light-dark adaptation, commonly known as night blindness. This is discussed more fully in Chapter 22. Long before other symptoms of vitamin A deficiency can be detected, a person may be unduly conscious of the glare of headlights in night driving. Night blindness and glare blindness are both evidence of the inability of the visual purple in the eye to adapt itself readily to changes in light intensity. This adjustment demands a liberal supply of vitamin A and seems to be one of the first mechanisms to suffer when a mild deficiency exists. If this visual defect is due to a vitamin A deficiency, it will be corrected promptly when an abundance of this factor is ingested.

One of the several instruments designed and recommended for measuring this power of adjustment was first used by Jeans for studying subclinical symptoms of vitamin A deficiency in children. Several other instruments were later developed and are useful for detecting those individuals who have poor light adaptation. However, this defect may not always be due to vitamin A deficiency.

Storage. Closely related to physiologic function is the body's ability to store vitamin A. It is estimated that the liver may contain as high as 95 per cent of the vitamin A content of the entire body, with small amounts in adipose tissue, lungs and kidneys. Infants and young animals probably have low reserves of vitamin A at birth; but if they are well fed they store it rapidly. The liver gradually acquires, over a period of years, an increasing reserve of vitamin A which normally reaches its peak in adult life. The advantage of this reserve is chiefly to take care of temporary shortages or increased requirements. Obviously an intake above minimum requirement must be maintained most of the time if such a reserve is to be built up. Reserve stores of vitamin A are evident even in young animals, because it takes from five to six weeks to deplete young rats in preparation for conducting bio-assays.

Chemical Nature and Properties. For years vitamin A was associated with a yellow color in plants but did not seem to parallel the pigment in animal foods. This observation was puzzling until the existence of a provitamin A—the yellow pigment, carotene—was established as responsible for the vitamin A activity of plants, whereas the true vitamin, which is but slightly pigmented, exists in many animal products. It is recognized today that there are four forms of carotene that possess vitamin A activity. These are alpha, beta and gamma carotene and cryptoxanthin, of which the beta-carotene is the most abundant and possesses about double the vitamin A activity of any of the other forms. The animal body, probably in the liver, is capable of transforming these precursors into true vitamin A, although some animal products (cream and butter) may contain both forms, because some of the provitamin may remain unchanged. Beta-carotene has been isolated as yellow rhomboid crystals, the pure vitamin A as long needles (Fig. 18).

Units and Methods of Assay. The International Unit (I.U.), which is the same as the U.S.P. unit, is defined as the activity of 0.6 mcg. (or 0.0006 mg.) of beta-carotene. The new crystalline vitamin A has a potency of 3,000,000 I.U. per gram. Fish-liver oils and commercial vitamin A concentrates are usually labeled in terms of I.U. per gram or per capsule. Vitamin A content of common foods is usually given in I.U. per 100 Gm. (See Table 1, Part Four.)

Bio-assay using rat growth as the criterion is still the standard method for the determination of vitamin A activity. For compounds such as fish-liver oils a more rapid chemical method of assay can be used, and its application to other products is being developed.

Human Requirements. The estimation of adult minimum requirements is usually based on the daily intake of vitamin A necessary to maintain normal dark adaptation. The recommended allowance of 5,000 I.U. daily for the average adult is approximately double the minimum requirement thus determined.

Infants seem to require more vitamin A to maintain a normal blood level than to prevent impaired dark adaptation. Which ever is the true measure of need, established practices of infant feeding usually ensure an adequate intake. No direct measurements of vitamin A requirements during pregnancy and lactation have been recorded, but by analogy from animal experiments the recommended allowance of 6,000 I.U. during pregnancy and 8,000 I.U. during lactation have been agreed upon as safe. (For complete table of vitamin A allowances for all age and sex categories, see Chap. 11.)

Food Sources. Fish-liver oils are the richest natural sources of vitamin A. However, they are usually classed as food supplements rather than as foods. They vary according to species and season when caught, but commercial brands are well standardized for our convenience.

All animal livers are good sources of vitamin A, but they are not as rich as fish liver. All milk products that include milk fat, such as butter, cream or full cream cheese, are rich in vitamin A. The milk of cows on green pasture is usually higher in vitamin A than is the milk of stall-fed animals, but the color is not an index of vitamin A potency.

Carotene is obviously abundant in carrots, from which it derives its name, but it is also present in even higher concentration in certain green, leafy vegetables and grasses in which the color of the chlorophyl masks the yellow of the carotene. In certain species such as corn there is more carotene, hence more vitamin A activity in yellow varieties than in white.

Animal foods that contain mostly preformed vitamin A seem to be more efficient sources of this factor for humans than the precursors found in plants. However, the ample supply of carotenes in plant foods may well contribute a large share of the vitamin A requirement for adults who have a normal capacity for converting carotene into vitamin A. The chart of Figure 18 shows the relative vitamin A values of some common foods. Although animal products appear to provide less than plant products, the form in which vitamin A occurs must be taken into account.

Stability in Foods. Vitamin A is gradually destroyed by heating in contact with air. This seems to be a process of oxidation accelerated by high temperatures. However, a long period of heating at low temperature seems to be more destructive than a short period at a slightly higher temperature. Thus, milk boiled quickly or pasteurized by up-to-date methods still retains a large proportion of the vitamin A originally present. Improved methods of evaporating and drying milk also limit the period of heating to a minimum so that very little vitamin A is lost. Open-kettle cooking of vegetables is more destructive to this vitamin than commercial or home-canning processes, where the product is heated in closed cans. Carotene is decreased in green, leafy vegetables by drying and wilting. Cool, moist storage helps to prevent the loss. Rancidity in fats destroys vitamin A.

VITAMIN D (CALCIFEROL)

Physiologic Significance. The history of rickets as a deficiency disease is much older than its association with a specific vitamin. Before 1921, when the antirachitic factor, now known as vitamin D, was still considered a part of the vitamin A complex, its function was recognized as concerned with calcium-phosphorus metabolism. Extensive research since then has answered many questions, but much still remains to be explained regarding the mechanism of the action of vitamin D. It is not specific for rickets as vitamin C is for scurvy. The absence of vitamin D alone will not cause rickets, unless the proportion or the total amounts of calcium and phosphorus in the diet are inadequate. However, when the latter condition exists, vitamin D controls the metabolism of the bone-building elements so as to make possible their most efficient utilization.

The low incidence of rickets in tropical climates suggested that sunshine might play a role in the prevention of rickets. Even after it had been demonstrated conclusively that it was the ultraviolet light from sunshine or from a special lamp that aided in the healing of rickets, it was difficult to understand the connection between this light effect and vitamin D from some food sources such as cod-liver oil. Eventually the puzzle was solved when it was discovered that vitamin D activity could be produced in certain foods by irradiation with ultraviolet light. The oily secretion of the skin is also activated when exposed to sunlight, and by reabsorption protects the body against rickets. The amount of ultraviolet light in sunlight varies with the season and the locality, as does the total amount of sunlight. These rays are also filtered out by fog, smoke and ordinary window glass. Thus it is obvious that an adequate natural source of ultraviolet light is impossible in northern climates during the winter months.

Rickets may be produced experimentally in rats, chicks, dogs and other animals by feeding a ration disproportionately high in calcium, low in phosphorus and deficient in vitamin D from any source. These animals will develop characteristic rachitic symptoms similar to those described in Chapter 22 for rickets in children. The deformities of leg bones and chest cavity with prominent beading of the ribs are the most conspicuous signs in a live animal.

Vitamin D is the only vitamin that has been demonstrated to have specific toxicity when administered in overdosage. Toxicity is not usually manifest except after huge doses, such as 500,000 I.U. daily (compare with daily requirement of 400 I.U.). The toxic action appears to be an exaggeration of its physiologic effects, abnormal calcification of growing bone and calcification of certain soft tissues. Headache, nausea and diarrhea may be the only subjective symptoms. Even the possibility of hypervitaminosis D, uncommon though it is, should discourage self-prescribed vitamin therapy.

Storage. Like other fat-soluble vitamins, vitamin D can be stored to some extent in the animal body, primarily in the liver. The reserve is depleted more rapidly when the calcium-phosphorus ratio is far from the normal, as it is in rachitic rations used for experimental purposes. For children who receive an adequate source of calcium and phosphorus, the requirement for vitamin D seems to be much less than for those who have a deficient intake or disturbed utilization of bone-building elements. When pregnant and nursing mothers are provided with an abundant source of vitamin D they are able to pass on some degree of antirachitic activity to the young, both prenatally and through the milk. An inadequate supply of vitamin D for the pregnant mother will predispose the young to early rickets, while offspring with better prenatal nourishment will resist the disease.

Rats to be used for vitamin D assays must be from a special colony fed on a ration low enough in this factor so that the young will not have a large reserve. Experimental rickets is difficult to produce when young rats are protected by vitamin D stored prenatally.

Chemical Nature and Properties. Research on the chemical nature of vitamin D were initiated in 1924, when Steenbock and Hess independent of one another demonstrated that antirachitic activity could be induced in foods by exposure to ultraviolet light. It soon followed that the factor activated was associated with fat, and that two fatlike compounds known as ergosterol and cholesterol were the precursors from which vitamin D was produced by the action of ultraviolet rays. Latest reports indicate that there are 14 different forms of vitamin D. However, the two important forms are vitamin D_2 (calciferol made by irradiation of ergosterol) and vitamin D_3 (formed by irradiation of a form of cholesterol). There seems to be a great difference in the activity of these forms in the chick, but as yet no apparent difference in humans. The discovery of the activation of fatlike substances by ultraviolet rays permitted the manufacture of a concentrated vitamin D preparation such as viosterol (irradiated ergosterol in oil) long before the pure crystalline vitamin D (calciferol) was isolated in 1935.

Units and Methods of Assay. The International Unit (I.U.) of vitamin D is the activity of 1 mg. of a standard preparation of 0.01 per cent solution of irradiated ergosterol in olive oil. One U.S.P. unit equals one I.U. Later when crystalline vitamin D was isolated one I.U. equaled 0.025 mcg. of calciferol.

Criteria used for judging the degree of experimental rickets are x-ray, total mineral content of bone and calcification of the metaphysis (the growing portion) of the long bones. The last observation has been used in developing the standardized line test on rats universally employed for routine assays of vitamin D preparations. Rats are fed on a rickets-producing diet until a definite stage of early rickets is produced, then the source of vitamin D or product to be tested is fed and the animals are sacrificed at the end of ten days. Longitudinal sections of certain bones are stained in silver-nitrate solution that darkens only the calcified areas. Figure 19 shows the progressive degrees in recalcification or healing that takes place in a rachitic bone when graded doses of vitamin D are administered.

Human Requirements. Who need vitamin D and how much is needed? These are the questions that have stimulated much research on this subject. Jeans and Stearns [4] state the basis for requirements as "those amounts which, with ample intakes of calcium and phosphorus and a diet otherwise adequate, insure sufficient retention of calcium and phosphorus to permit (a) normal growth and mineralization of the skeleton and teeth of infants and children, (b) maintenance of bony and dental structures during adult life and (c) a sufficient supply for mother and infant during pregnancy and lactation.”

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[4] Jeans and Stearns: J.A.M.A. **111**:703, 1938.

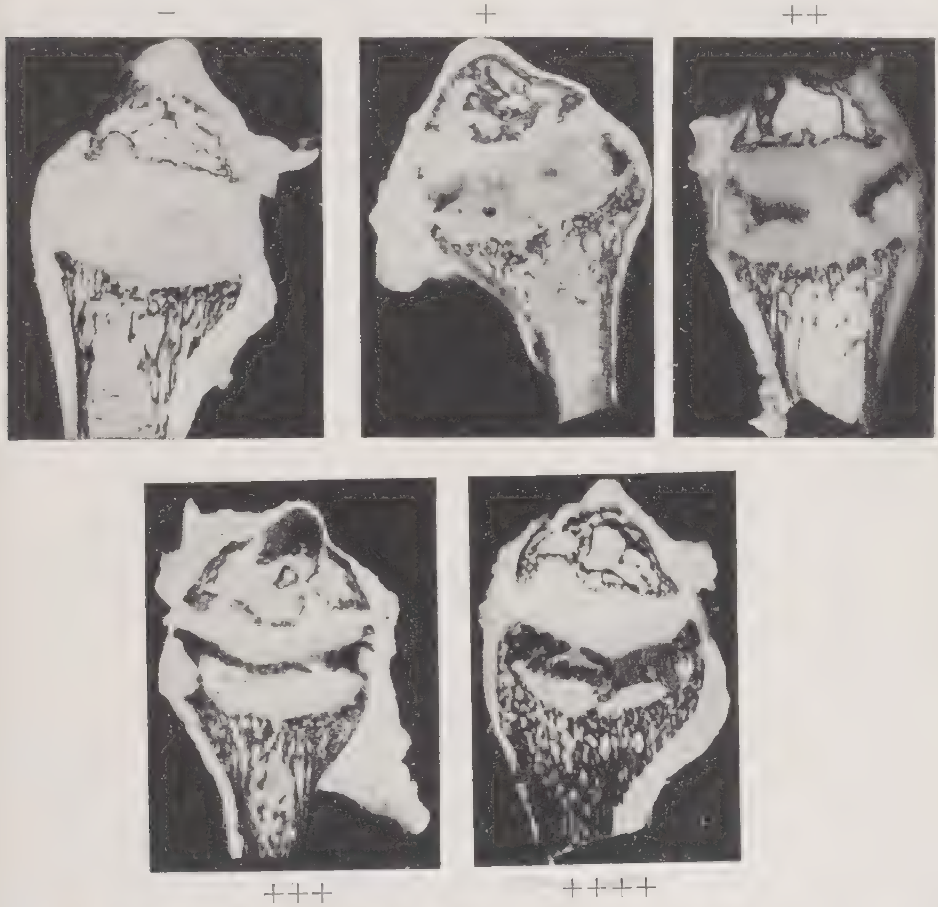

FIG. 19. Progressive degrees of recalcification or healing of rachitic bones due to graded doses of vitamin D. The increasing extent of the dark areas, where the white band appeared in the first photo, indicates new mineral deposits. Photo marked ++++ represents one Steenbock or 2.7 U.S.P. units of vitamin D. (Wisconsin Alumni Research Foundation.)

A quantitative estimate for children depends upon the age of the child, the rate of growth, the type of food eaten and the exposure to sunlight. Premature and rapidly growing infants need more than others, breastfed infants less than those fed on cow’s milk, children under two years more than older children because they are more susceptible to rickets. There is considerable evidence that vitamin D is effective in arresting and preventing dental caries in preschool and school-age children. Thus the figures given for recommended vitamin D allowances for infants and children are subject to many variables that are covered by giving from 400 to 800 I.U. to infants and 400 I.U. to older children and adolescents.

For adults too little evidence is available to be able to give quantitative estimates of requirements, but many authorities believe that some vitamin D is advisable for all persons deprived of sunlight and for elderly persons. Other adults probably have little need of vitamin D, according to the Food and Nutrition Board recommendations.

During pregnancy and lactation there is a definite need of vitamin D, both for mother and for offspring. Many authorities advise more than the allowance of from 400 to 800 I.U. recommended by the Food and Nutrition Board. However, it is emphasized that no amount of vitamin D can lower the minimum calcium requirement. (See Chap. 7.)

Natural and Artificial Sources. The natural distribution of vitamin D in common foods is limited to a small amount in cream, butter, eggs and liver. Thus we have come to depend upon the vitamin-rich fish-liver oils as valuable supplementary sources. Of the numerous oils investigated, there is a wide range of potency varying with the season of catch and inversely with the yield of oil. Any of these vitamin D supplements on the market, such as pure viosterol and plain or reinforced fish-liver oils, are usually labeled with exact units per dose or per capsule and are prescribed accordingly. The curvative dose is considerably more than a protective dose.

For children who never receive any vitamin D supplement a food fortified with extra vitamin D may be desirable. The Council on Foods of the American Medical Association expresses the opinion: [5]

"Of all the common foods available, milk is the most suitable as a carrier of added vitamin D. Vitamin D is concerned with the utilization of calcium and phosphorus, of which milk is an excellent source.

Most of the vitamin D milk now being marketed by reliable dairies is produced by adding a vitamin D concentrate to the milk and is an acceptable and convenient source of this factor. The present standard is 400 I.U. per quart. Promiscuous vitamin D reinforcement of a variety of other foods seems unnecessary and undesirable.

Stability. Vitamin D in foods and in food concentrates is remarkably stable to heating, aging and storage. Vitamin D milk that is warmed for the baby or the cod-liver oil that may have been kept over a season are reliable sources of this factor.

VITAMIN E (TOCOPHEROL)

Physiologic Significance. The existence of a dietary factor essential for reproduction in the rat was recognized in the early 1920's by Evans and was given the name vitamin E or antisterility factor by Sure in 1924. Most of the experimental work has been done on rats, the males and the females being affected differently. Vitamin E deficiency leads to destruction of germ cells in the testes of the male and thus to permanent sterility. In a female, mated with a normal male, ovulation and implantation of the ovum may take place normally, but about half way through the gestation period resorption of the developing fetus occurs and no young are born. With less severe vitamin E deficiency, which may permit the birth of a weakling litter, the chances of survival are poor because this same deficiency seems to interfere with lactation. There is less agreement about the need of larger animals for vitamin E, but there is some evidence that cattle and swine do require it. Evidence points to a close correlation between the vitamin E content of the diet of hens and the hatchability of their eggs and the viability of the chicks that are hatched. The role of vitamin E in human reproduction and its possible therapeutic usefulness in the prevention of abortion is controversial but worthy of further study.

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[5] Council on Foods: J.A.M.A. 108:206, 1937.

Earlier work on nutritional muscular dystrophy in rabbits has recently been repeated with other animals and the nutritional deficiency factor identified as vitamin E. Thus the so-called reproductive vitamin has come to have a new significance not associated with reproduction. Herbivorous animals are more susceptible to muscular dystrophy than are carnivorous. It is too early to say how significant this factor may be in human muscular dystrophy, although improvement in a few cases has been reported.

Studies have shown that vitamin E deficiency is also accompanied by retardation of growth in the rat. This does not become apparent until later stages of growth. Changes in endocrine glands are reported to appear following vitamin E deficiency.

Storage. It requires several months for rats to use up their reserve and to become sterile due to a diet deficient in vitamin E. Vitamin E is stored in muscles and in fatty tissues, and not in the liver as are the other fat-soluble vitamins.

Chemical Nature and Properties. Three naturally occurring compounds have vitamin E activity. They are fat-soluble alcohols of high molecular weight, closely related in structure and called alpha-, beta- and gamma-tocopherols. Alpha-tocopherol is the most active form. Tocopherols are more stable than most other vitamins, but they are destroyed when in contact with rancid fats. In many natural foods so-called antioxidants occur. They delay or prevent this destruction. Alpha-tocopherol deteriorates on exposure to light and decomposes upon irradiation with ultraviolet light. Contact with lead and iron hastens destruction.

Units and Methods of Assay. No International Unit was ever established for vitamin E, but 1 mg. of alpha-tocopherol is more or less accepted as a unit. The Evans Unit is based upon the bio-assay method used, namely, the amount of material necessary to ensure birth of a litter of rats after a normal gestation period of 21 days. The Evans Unit is approximately equal to 3 mg. of pure alpha-tocopherol.

Human Requirement. The uncertainty regarding the significance of vitamin E in human nutrition precludes any possibility of determining human requirement.

Food Sources. Wheat germ and wheat-germ oil afford the richest source of this factor, but it is so widely distributed in common foods that it is even difficult to obtain for experimental purposes a food mixture that is deficient in vitamin E. Tests show that vitamin E is present in cereal germs, egg yolk, legumes, nuts, leafy vegetables and vegetable oils: that it is absent in cod-liver oil, a rich source of A and D; in yeast, a rich source of the B complex; and in orange juice, a rich source of C. Thus is precluded its close relationship to other known vitamins.

VITAMIN K (MENADIONE)

Physiologic Significance. About ten years ago a severe hemorrhagic disease in newly hatched chicks was recognized by Dam in Copenhagen. The chick ration was adequate in protein, in minerals, and in all known vitamins. The hemorrhage in the chicks was apparently due to a fall in prothrombin, the clotting agent in the blood. Normal clotting time was restored by administering hog-liver fat or by feeding alfalfa. The antihemorrhagic factor found in these materials Dam called vitamin K—"Koagulationsvitamin."

In the short time since this discovery, rapid progress in the identification, the isolation and the synthesis of products with vitamin K activity has made possible extensive clinical use of this new vitamin for the control and the prevention of types of hemorrhage. When there is a fall of the prothrombin level of the blood such as occurs in hemorrhages associated with hepatic or biliary disease, vitamin K appears to be almost specific according to recent clinical reports.

Vitamin K deficiency in food is probably rare, but the deficiency state is caused more likely by failure to absorb or utilize the vitamin in the food. The absorption of vitamin K from the intestine seems to be dependent upon the presence of bile and the normal digestion and absorption of fats. The use of mineral oil in reducing diets or as a laxative may interfere with the absorption of vitamin K. In pregnancy the use of mineral oil should be avoided because the resulting low prothrombin level may predispose to hemorrhage, miscarriage or hemorrhagic disease of the newborn infant. After absorption, vitamin K is apparently necessary for the liver cells to perform their normal function of forming prothrombin.

Storage. Vitamin K is not stored easily in the body, but according to clinical reports whatever is stored is in the liver.

Chemical Nature and Properties. Vitamin K, the newest of the fat-soluble vitamins, is a yellowish crystalline substance termed menadione. Recent observations indicate that at least two forms of this vitamin (K_1 and K_2) occur naturally, and that a number of simpler substances with antihemorrhagic properties have been synthesized. They are heat-resistant, but are destroyed by alkalis, strong acids and certain oxidizing agents. In the concentrated form vitamin K seems to be sensitive to light.

Units and Methods of Assay. No single unit of vitamin K activity has been agreed upon, but it can be measured in terms of micrograms of the pure synthetic compound—menadione—and the activity of other substances can be expressed in terms of that one.

Methods of assay depend upon the antihemorrhagic activity of a given material. One method uses young chicks and is based on the minimum dose that will maintain the normal coagulation time of the blood at the end of one month.

Human Requirement. For most people the vitamin K content of the average diet is adequate, and no quantitative estimate of human requirement has been attempted. Its use is confined largely to the therapeutic.

The prophylactic use of vitamin K in the prevention of hemorrhage in the newborn is now recommended and practiced in many hospitals. Oral administration of a vitamin K preparation to the mother before delivery and one dose of 1 or 2 mg. intramuscularly to the infant immediately after birth is considered a practical public-health measure.

Sources. Vitamin K is fairly widely distributed in foods. It appears abundantly in green leaves, alfalfa, casein, pork liver, soybean oil and certain other vegetable oils. It is not present in fish-liver oils, but as a result of bacterial action it is synthesized in decomposed fish meal. Vitamin K activity from this source differs slightly from vitamin K of alfalfa.

WATER-SOLUBLE VITAMINS

Ascorbic Acid (Vitamin C)

Physiologic Significance. The history of the recognition of scurvy as a deficiency disease in man and of its subsequent control is discussed in Chapter 22. The discovery that experimental scurvy could be produced in guinea pigs was made by Holst and Frölich in Norway in 1907. Guinea pigs develop characteristic hemorrhages round joints, teeth and other bony structures similar to the disease in man. Other animals, such as the rat and the chicken, also the dog and certain other domestic animals, fail to develop any sign of scurvy when deprived of vitamin C because they are able to synthesize this factor in their bodies Man, monkeys and guinea pigs do not have this ability and must, therefore, depend upon the vitamin C in their food. Vitamin C has therefore been called the antiscorbutic factor.

Vitamin C has several functions in life processes, one of which is its highly significant role in the formation and the maintenance of the intercellular cement-like substance of many tissues. A shortage of vitamin C in this connection results in weakened capillary walls leading to hemorrhages of varying degree. Other important observable indications of a shortage of this vitamin are structural changes in bones and cartilage, gums and teeth (dentin). Anemia due to interference with the functioning of blood-forming cells in the bone marrow, as well as a loss of blood by hemorrhage, has been recognized. If the pathologic changes have not proceeded too far, the response to the administration of liberal vitamin C is striking within a few days. Clinical experience with a number of diseases such as tuberculosis, pneumonia and rheumatic fever shows a decreased excretion of ascorbic acid even with an increased intake. There is some question as to whether a suboptimal intake of vitamin C is a predisposing cause of any of these diseases or whether there actually is some increased demand for vitamin C as a result of the disease. Workers have shown that a shortage of this vitamin in laboratory animals lowered resistance to bacterial toxins, and that this was evident before there was any external sign of scurvy. It is essential for the normal healing of wounds and is now being used therapeutically to speed recovery from surgical operations.

Storage. The promptness with which man excretes an excess supply of vitamin C in the urine indicates limited powers of storage. After periods of depletion or shortage more vitamin is retained until the tissues seem to become saturated. Following saturation the excess is again excreted. It is generally believed that a habitual intake of vitamin C of between 60 and 100 mg. daily will keep a person in a state approaching saturation, which condition is probably more conducive to optimum health than one in which there is no reserve. The rapid appearance of symptoms of scurvy in guinea pigs on scorbutic rations is further evidence of poor storage.

Chemical Nature and Properties. By 1932 the isolation of vitamin C in pure crystalline form had been accomplished by two groups of workers, one in Pittsburgh and one in Hungary. The chemical structure was identified and the product synthesized in physiologically active form soon after that, and "ascorbic acid" was officially accepted in 1938 as the chemical name for vitamin C.

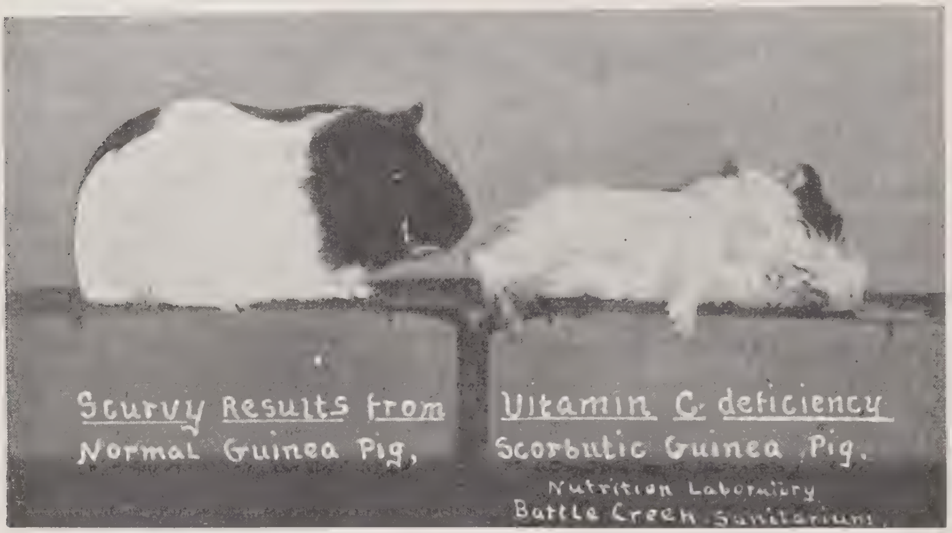

FIG. 20. Guinea pigs are used for experiments on vitamin C because they need a food source of this factor just as humans do.

Ascorbic acid is a white, odorless powder, freely soluble in water and strongly acid in taste. Aqueous solutions of ascorbic acid are quite unstable, but in fruit juices it is less rapidly oxidized owing to the acidity of the juices and the protective substances in them. In the tablet form now being offered by numerous pharmaceutic companies, ascorbic acid is inexpensive and stable if kept free from moisture.

Units and Methods of Assay. Since ascorbic acid can be conveniently measured chemically, it has become customary to give the number of milligrams rather than the number of International Units (1 mg. = 20 I.U.).

Ascorbic acid is an active reducing agent and rapidly bleaches a certain blue dye (2, 6-dichlorophenolindophenol). This reaction has been adapted as a chemical titration for the quantitative determination of ascorbic acid in food, in tissues, in excreta, etc. This shorter and easier method checks well with the more tedious bio-assay and has, therefore, practically replaced it for clinical and research purposes.

Guinea pigs have always been the preferred experimental animal for bioassay work because of their susceptibility to a deficiency of ascorbic acid, and they are still used for demonstration and comparative assays.

Human Requirement. Elaborate studies have been made to determine human requirements for ascorbic acid at different ages, under different conditions of environment, under physical exertion, in fevers and in infections. The amount necessary to prevent frank symptoms of scurvy in humans is far less than that recommended for an optimum state of health. Saturation tests after graded levels of intake and observations on blood ascorbic acid have been the chief technics used for studying human requirements. On the basis of such studies the National Research Council recommends 75 mg. for an average man and 70 mg. for a woman, 100 mg. during pregnancy and 150 mg. during lactation. Growing children need relatively more than adults. (See table, Chap. 11.) During and following fevers and infections the demand for ascorbic acid seems to be increased, either because of rapid destruction or of an increased need. A regular and an adequate intake of ascorbic acid is emphasized because of the poor storage and constant need. Food sources are usually adequate, except in pathologic states or when fresh foods are not available.

Food Sources. Citrus fruits and certain raw, leafy vegetables are among the richest natural sources of vitamin C. Tomatoes and other fruits and vegetables, even when canned, furnish a liberal supply of this factor. Canned citrus juice may be the cheapest source of vitamin C when fresh citrus fruit is scarce or expensive, and may even be cheaper than tomato juice unless home-canned, because it takes twice as much or more tomato to supply the same number of units of vitamin C. In season, strawberries or melon may replace citrus fruits as equally good sources of ascorbic acid. Ascorbic acid is synthesized in the young sprouts of beans or grains and is richer in young leaves or roots than in mature plants. Leaves such as cabbage and spinach are good sources, especially if fresh and eaten raw. Turnip when eaten raw has a higher value than other root vegetables. Turnip juice was an important antiscorbutic in northern Europe in World War I. Potatoes, although containing much less vitamin C than many other common foods, may become an important source when a large amount is consumed. The relative ascorbic-acid content of average servings of some common foods is given in the chart on next page. No animal food is an important source of this vitamin. Liver, which contains the most, loses much of it when cooked. Milk is a relatively poor and a variable source, depending somewhat upon the feed of the cow and even more upon the way in which the milk is handled. Mother's milk contains from four to six times as much ascorbic acid as average cow's milk.

Vitamin C is one of the most difficult nutrients to supply in adequate amounts to troops or civil populations in wartime because of its instability in stored foods. In World War II the need for a liberal amount of this factor was recognized and army rations included a lemon powder fortified with ascorbic acid. Most of the other items in the emergency ration contained very little vitamin C. If men did not like lemonade, as was frequently the case, the ration was low in this factor. Civil populations in north temperate zones, deprived of imported citrus, fell back on native sources. In Great Britain, rose-hip and black-currant sirups or jams served to supplement the meager supply from garden vegetables. Even before the war in northern Russia an extract of pine needles rich in vitamin C was being added to berry juice as a health beverage for school children.

Stability in Foods. Of all the vitamins, ascorbic acid is the most unstable to heat, oxidation, drying and storage. Alkalinity, even in a slight degree, is distinctly destructive to this vitamin; therefore, soda should never be added to food in cooking. Acid

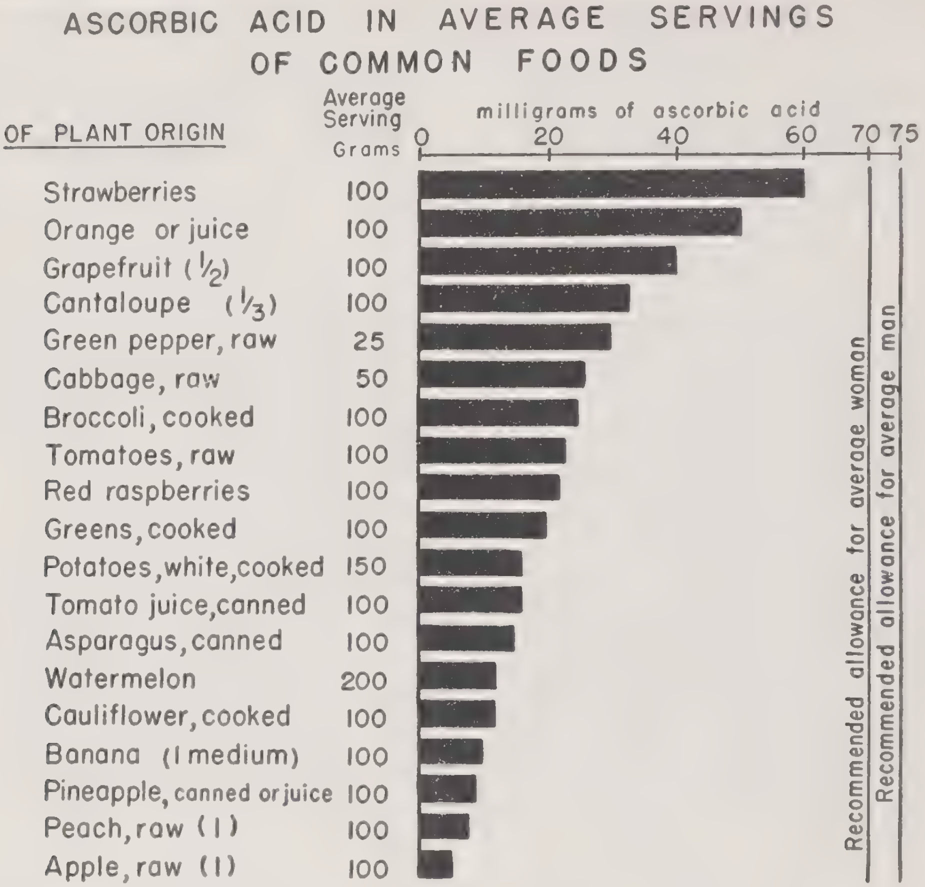

FIG. 21.

fruits and vegetables lose much less ascorbic acid upon heating than nonacid foods. Vitamin C is extremely soluble in water and dissolves out of vegetables during the first few minutes of cooking.

To reduce as much as possible the loss of ascorbic acid in cooking vegetables, the use of the least possible amount of cooking water, short cooking time (water should be boiling when vegetable is added) and little chopping or cutting is recommended. Studies have shown that baked, boiled or steamed potatoes retain a large portion of their vitamin C if cooked whole. Fresh fruits and more especially vegetables lose vitamin C activity rapidly when stored at room temperature and somewhat less rapidly at refrigerator temperatures. Expert advice is not to shell peas, cut beans, hull strawberries or cut roots off spinach until ready to cook. Quick freezing of fruits and vegetables destroys little if any of this factor. To retain a maximum of the ascorbic acid, frozen fruits should be used promptly after thawing and frozen vegetables should be plunged directly into boiling water for cooking.

VITAMIN B COMPLEX

Discovery and Early Significance. As early as 1879 Eijkman, a Dutch physician stationed in Java, noticed that the poultry of the establishment showed symptoms similar to those of his patients suffering from beriberi. This malady developed in the chickens when they were fed on the polished-rice table scraps thrown out from the prison, and recovery followed when other food was given. The results of the investigation were published in an obscure journal, but not until many years later was attention given to the findings or to the scientific significance attached to them. Eijkman had discovered that there was a deficiency in polished rice, but he did not name it.

Experimental work with rats, pigeons and dogs during the early part of this century led to the recognition of a hitherto unknown food essential that came to be known as vitamin B. Animals deprived of this factor lost appetite, ceased to grow, and often developed characteristic symptoms of polyneuritis, a loss of muscular control and partial paralysis. Many of these symptoms in animals were similar to those of beriberi in man, particularly the effect upon the nervous system. These findings gave rise to the term antineuritic.

Subdivision into Separate Factors. Numerous workers began to observe a complexity of symptoms due to deficiencies among peoples with different dietary patterns. These reports were confusing until the discrepancies in experimental findings and the diversity of physiologic properties ascribed to this so-called vitamin B led to the recognition of several factors instead of one. From then on the group was known as the vitamin B complex, and each fraction received separate designation—letter, descriptive name or chemical term—as research progressed to disclose the chemical nature of each.

At present some 12 fractions of the vitamin B complex are generally recognized, and others are postulated. Those discussed in this chapter are thiamine, riboflavin, niacin, pantothenic acid, pyridoxine and biotin, with brief comments about several others.

Distribution and Properties. Certain properties, the solubility in water and the distribution in many common foods, are common to all members of the B complex. The very fact that several of the fractions occurred together in the same food gave rise to the early idea that there was one substance. New factors identified are classified as belonging to the B complex if they are water-soluble and have similar distribution in common foods. Dry yeast is the richest natural source of the B complex, and new strains are being developed with varying proportions of the different factors.

Therapeutic Use. Concentrates of vitamin B complex manufactured by pharmaceutic houses are usually made from liver, yeast or rice polishings. The proportion of the various factors present depends somewhat upon the source or the combination of sources. Synthetic vitamins may be combined in any desired proportion in the preparation of B complex mixtures. Obviously a proportion of factors corresponding approximately to human need would be most desirable. Borsook and coworkers[6] concluded from their clinical work that the whole B complex was superior therapeutically to any single fraction.

THIAMINE (VITAMIN B_1)

Physiologic Significance. The polyneuritic symptoms recognized by Eijkman in his chickens and the beriberi in man described by numerous workers in the Orient were all due to the vitamin B_1 fraction of the B complex. In 1910, R. R. Williams became interested in beriberi in the Philippines and in the curative effects of rice polishings. He started a 25-year search for the active principle in rice polishings, bran and other natural foods. Later it was named thiamine, as descriptive of its chemical nature. It is often described as antineuritic, antiberiberi or the nerve-control vitamin because of its physiologic functions.

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[6] Borsook, H., *et al.*: Am. J. Digest. Dis. 5:246, 1938.

Even a mild deficiency of this factor may cause anorexia (loss of appetite) and inanition in all types of animals and man. Early recognition of the necessity of this vitamin for normal growth has since been supplemented by the knowledge that it is important throughout life in tissue respiration. There is an intricate interrelationship between thiamine and carbohydrate metabolism. Authorities have recognized for some time that the human requirement tends to parallel the total caloric intake. More recently, however, the emphasis has been on nonfat calories. Thiamine deficiency leads to disorders of endocrine function, of the digestive system as well as of the nervous system. A common complaint often due to a mild thiamine deficiency, but not always recognized, is atonic constipation and poor intestinal muscle tone. It is possible that the muscle-nerve mechanism of internal organs is more susceptible to this deficiency than that of the skeletal muscles, which become paralyzed only when the deficiency is severe. Certain British workers suggest that the degree of slowing of heartbeat (bradycardia) may be indicative of this deficiency.

Work conducted at the Mayo Clinic has disclosed the characteristic syndrome of early thiamine deficiency in human subjects. Thiamine alone was restricted in the diet of some nurses and other volunteers. These subjects were under careful supervision as to food, and the urinary excretion of thiamine was also checked. Williams et al. summarize their findings as follows: [7]

"The degree of disability induced by withdrawing thiamine from otherwise adequate diets of these persons was impressive. Fatigue appeared, interest in daily tasks was lost, accompanied by discouragement, depression and irritability. Appetite was lost. Multiple neurasthenic complaints were heard. The heart sounds became faint, blood pressure fell, the pulse was irritable, and as the duration of the restriction was prolonged, abnormalities in the action of the heart and mobility of the stomach and intestine could be recorded with special apparatus."

Storage. Thiamine cannot be stored to any extent in the animal body. Therefore, it is important that it be supplied regularly in the diet. In America the food supply is such that one is relatively sure to have enough thiamine to prevent beriberi, but frequently not enough to ensure optimum health. Many a vague symptom of tiredness or chronic constipation may be aggravated by suboptimal intake of thiamine. In conducting bioassays, experimental animals can be depleted rapidly of their thiamine stores provided they are caged in such a manner as to prevent contact with excreta, since the craving for thiamine by an animal deprived of it will cause him to attempt to re-utilize the small amount excreted in the feces. Many animals, especially cattle and other ruminants, synthesize thiamine and other factors of the vitamin B complex by bacterial action in the alimentary tract. When the bacterial flora of the intestine is favorable, humans may also synthesize thiamine.

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[7] Williams *et al.:* Arch. Int. Med. **66**:785, 1940.

Chemical Nature and Properties. Thiamine forms a salt with chlorides and is usually isolated or synthesized in that form. Thiamine chloride is a white crystalline substance (see Fig. 17) with a nutlike and a salty taste and a yeasty odor. It is readily soluble in water. Thiamine was synthesized by Williams in 1936. The natural and the synthetic products are identical in physiologic activity. In the dry state thiamine chloride is stable and is not easily destroyed by heat or oxidation. In water solution it is less stable, but more stable in acid than in neutral or alkaline medium.

Units and Methods of Assay. Now that the chemical nature of thiamin is known, it can be measured by metric weight of the pure substance and expressed either in milligrams or in micrograms. Food values are often given in micrograms (1 mg. = 1,000 mcg.) to avoid the use of decimals. Human requirements and potency of synthetic compounds or concentrates are usually expressed in milligrams. The International Unit (I.U.) formerly employed for vitamin B_1 before it was chemically identified is no longer used extensively (1 mg. = 333 I.U.).

Chemical and microbiologic methods of assay have largely replaced the older bio-assay methods, in which rats and pigeons were used as experimental animals. The bio-assay is occasionally employed for check or comparison with other methods. A standardized sample of pure thiamine chloride is more often used for comparison. Now that these rapid methods of assay are available, extensive determinations of vitamin values of foods before and after storage and cooking are possible, and tables of food values are being revised to include such figures.

Human Requirement. Adult human thiamine requirements tend to parallel energy expenditure except for extremes of caloric intake. Thus the Food and Nutrition Board recommends from 1.2 to 2.0 mg. for men and from 1.1 to 1.5 mg. for women, varying with the degree of activity, and relatively more during growth, pregnancy and lactation. (See table, Chap. 11.)

Estimation of requirement is based upon the response to graded doses and the urinary excretion of a marginal surplus compatible with a sense of well-being. Deficient subjects usually excrete less than 50 mcg. daily.

Food Sources. Thiamine is widely distributed in a large variety of animal and vegetable tissues, but there are few foods in which it occurs in abundance. This is strikingly emphasized in the chart on next page, which shows the thiamine content of average servings of some common foods and the contribution they make toward the day's requirement. It is evident that it takes several servings of even the better sources of thiamine to meet the recommended allowance. It was for this reason that enrichment of bread and cereals was instigated, to make it easier for the average person to meet his requirement economically. Dry yeast and wheat germ are the richest natural sources, but they are used only in relatively small amounts. Moist baker's yeast has only from one eighth to one tenth of the thiamine potency of brewer's yeast. Except for pork, which is outstanding, muscle meats contain less than

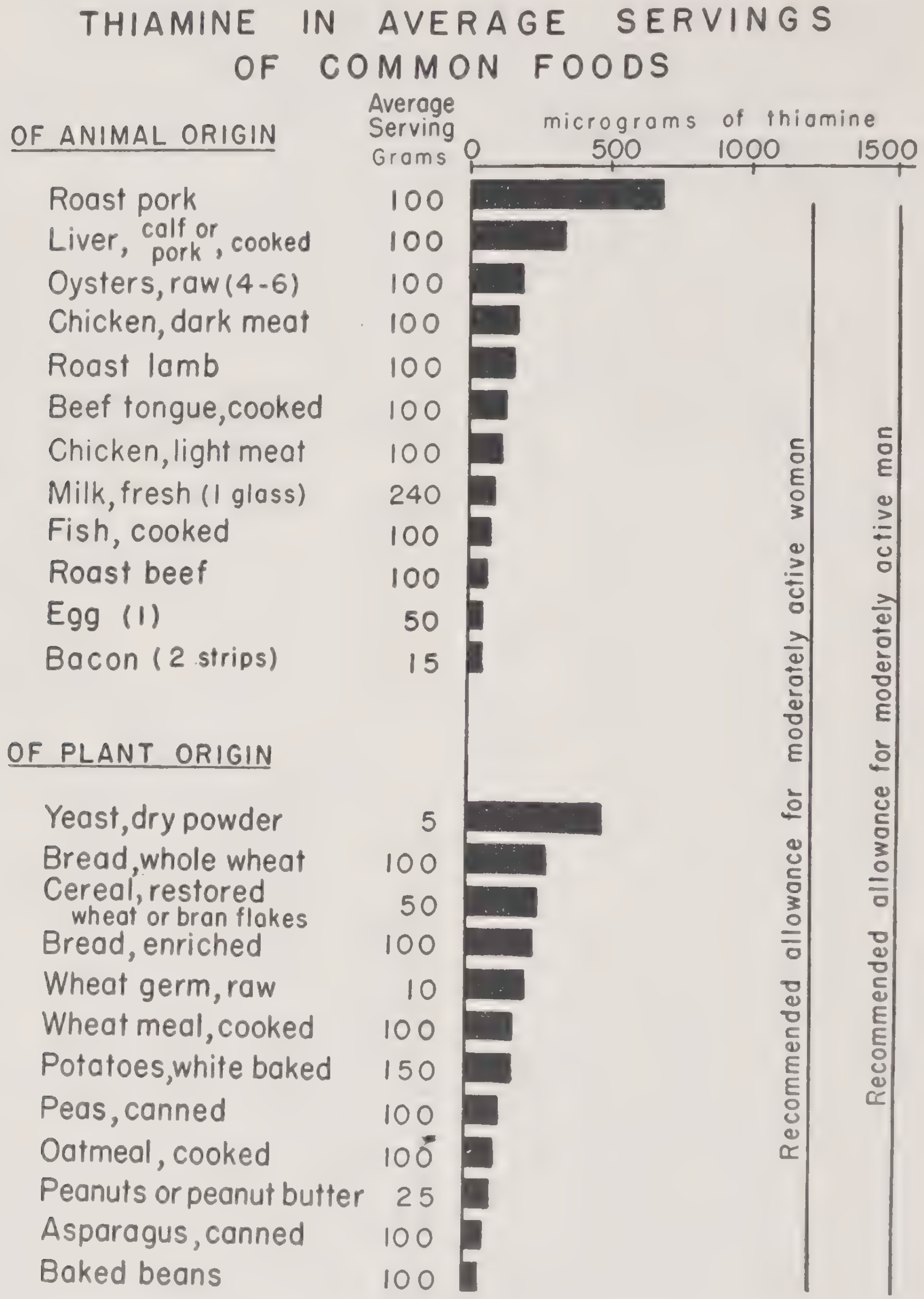

Fig. 22.

the organs, such as liver, heart and kidney. Fruits in general are not important sources of this vitamin.

The recognized difficulty of meeting thiamine requirements from natural food sources has brought about the movement to increase the thiamine content of certain foods. Since bread constitutes about one fourth of the calories in the average American diet and since only a very small fraction of the bread consumed in this country is made from whole wheat, the enrichment of white flour and bread with thiamine, riboflavin, niacin and iron was a logical step toward improving the level of nutrition in the United States. For more details about enriched flour and bread see Chapter 50.

Stability in Foods. The factors most destructive to thiamine in foods are prolonged heating and alkali. In acid foods this vitamin is quite stable, but its activity is rapidly destroyed by sulfite, a fact which may explain the loss of thiamine in dried fruits treated with sulfur.

The loss in cooking is dependent upon several factors, such as type of food, method of preparation, temperature, length of cooking and acidity or alkalinity of the cooking medium. A review[8] of the losses of nutrients in food processing indicates that on the whole fresh vegetables retain thiamine well during cooking. From a trace to 15 per cent is dissolved in the cooking water and up to 22 per cent may be destroyed by cooking. If the cooking water is discarded, thiamine losses may be from 20 to 35 per cent.

Thiamine is well retained in cereals, since they are generally cooked slowly and at a moderate temperature and the cooking water is used. Baked products lose about 15 per cent of their original thiamine. Generally, the losses in cooking meat are greater than in other foods, roughly 40 per cent. Foods stored in their natural condition lose remarkably little thiamine.

RIBOFLAVIN (VITAMIN B_2)

Physiologic Significance. The second member of the B complex—riboflavin—was synthesized in 1935. This factor is intimately associated with normal growth and development both in mammals and in birds. Like thiamine, riboflavin plays an important role in tissue respiration. It combines with phosphoric acid and protein to form enzymes that control some of the oxidations involved in the life processes of living cells.

Sebrell and coworkers have demonstrated that riboflavin deficiency in man may be characterized by pallor of the mucous membrane of the lips and splitting of the lips at the angles of the mouth, a condition known as cheilosis.

Riboflavin also plays an important role in relation to the eye. Ocular symptoms appear consistently on a low riboflavin diet and may precede all other manifestations. Eyestrain and fatigue, itching and burning, sensitivity to light and frontal headaches are the most frequent complaints. Cataracts have been observed in rats, in mice, in chickens and in monkeys after prolonged deficiency of riboflavin. Such a diet may also lead to neurologic abnormalities with myelin degeneration of peripheral nerves and spinal cord in experimental animals. In man, riboflavin deficiency is apt to occur along with a deficiency of other members of the B complex.

Storage. There is no great storage capacity in the body for this vitamin. It has been suggested that under stress the body can conserve its store of riboflavin much better than it can conserve thiamine. In rats that die from riboflavin deficiency, the liver, the kidney and the heart still retain about one third of the normal amount.

Chemical Nature and Properties. Riboflavin belongs to the group of chemical compounds called flavins because of their yellow color. The prefix ribo- refers to a part of the molecule that resembles the sugar ribose. Riboflavin crystallizes in a cluster of yellow needles, as shown in Fig. 17. In water solution it has a yellow-green fluorescence. Although it is stable to heat, acid and oxidation, it is sensitive to alkali and is easily destroyed by light. This vitamin should always be kept in dark bottles.

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[8] Vail, G. E.: J. Am. Dietet. A. **18**:569, 1942.

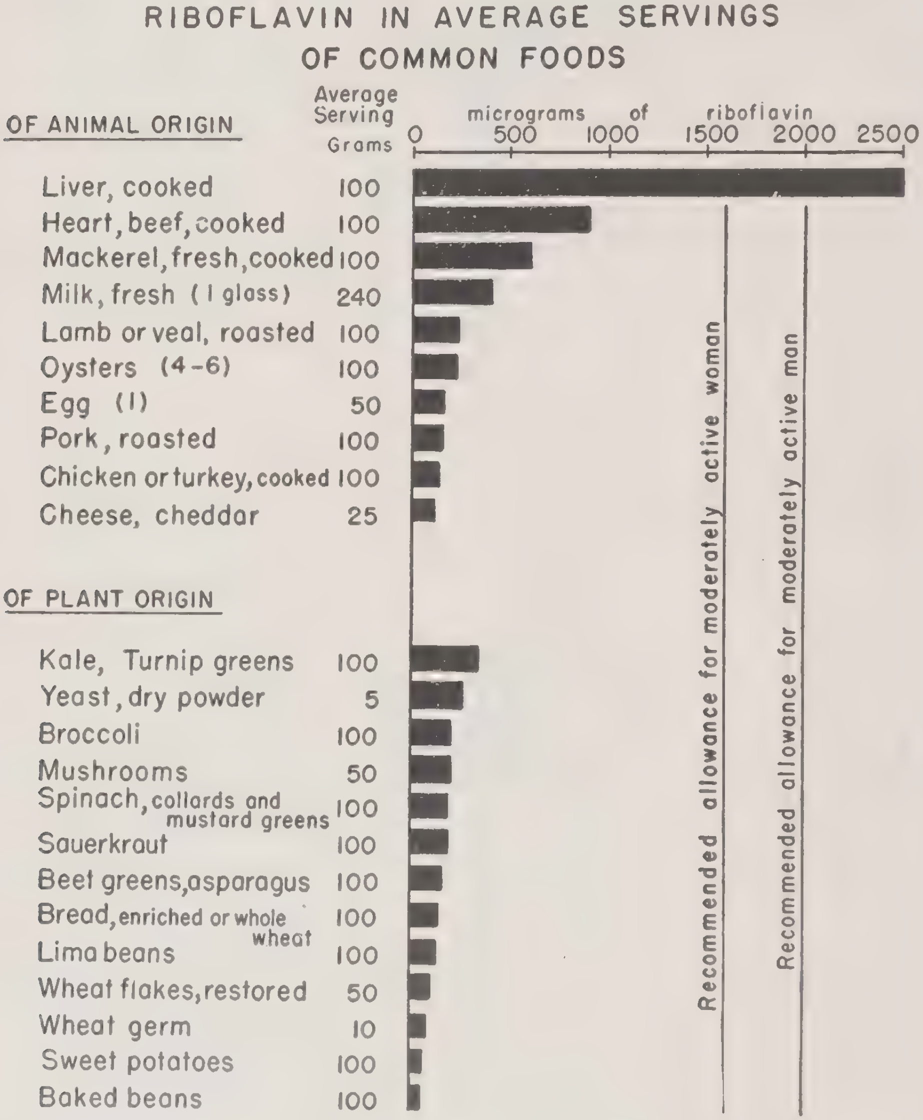

Fig. 23.

Units and Methods of Assay. The only reliable unit for riboflavin is the metric weight of the pure substance. Human requirements for this vitamin are expressed in milligrams and the amount in foods in micrograms in order to avoid the use of decimals. The old unit for vitamin G based on growth response is not considered a true measure of riboflavin.

Physical-chemical and microbiologic methods of assay are used for determining the riboflavin content of foods, tissues, etc.

Human Requirement. Like thiamine, the human requirement for riboflavin tends to parallel energy expenditure. Thus the Food and Nutrition Board recommends from 1.6 to 2.6 mg. for men and from 1.5 to 2.0 mg. for women, according to degree of activity. These figures are considerably lower than those given previously. The revision downward was warranted as more data on human requirement became available. The greater relative need for riboflavin during growth, pregnancy and lactation is reflected in the specific recommendations for these categories. (See table, Chap. 11.)

Food Sources. Riboflavin is widely distributed in animal and in vegetable foods, but only in small amounts in most of them. Organ meats, milk and green leafy vegetables are the outstanding food sources. This is strikingly emphasized in Figure 23, which shows the riboflavin content of average servings of some common foods and the contribution they make toward the day's requirement.

Dry yeast is the richest natural source, but this product is not generally consumed in large amounts. The average person is not apt to get an optimum amount of riboflavin unless he consumes a generous amount of milk. The addition of riboflavin in the enrichment of flour and bread has helped to raise the average intake.

Stability in Foods. Studies have shown that riboflavin in aqueous solution is rapidly destroyed by light. Several investigators have made tests of the amount of destruction of riboflavin in milk, since it is an important source of this vitamin. Results of these studies show that the destruction by light is significant and likely to be more serious while in the bottle that has been left outside the door than during processing or cooking. As a practical measure to conserve the riboflavin in milk, it is important to see that milk is not allowed to stand outside after delivery.

NIACIN (NICOTINIC ACID)

Physiologic Significance. When Elvehjem reported the spectacular cure of blacktongue in dogs by means of nicotinic acid, now known as niacin, the logical supposition was that a niacin deficiency might be the cause of pellagra in humans. Later Spies and others demonstrated that most of the classic symptoms of pellagra were relieved by the administration of niacin. However, most persons suffering from pellagra have multiple deficiencies, and it has been found that certain symptoms formerly associated with the disease are not relieved until thiamin and riboflavin are supplied along with niacin. Human pellagra is fully discussed in Chapter 22. Niacin is also associated with the enzyme systems in tissue respiration.

Storage. Little is known regarding the extent of storage of niacin in the body, but it is probably stored in the liver. It is eliminated in the urine largely as the derivative trigonelline and, to a smaller extent, as nicotinuric acid and free niacin. This diversity of end products has added to the difficulties of metabolic studies in niacin.

Chemical Nature and Properties. Niacin is a white crystalline substance with slightly acid taste more soluble in hot than in cold water and easily dissolved out of foods in cooking.

Nicotinic acid has long been known as a simple organic compound, but its physiologic properties were not appreciated until it was isolated from potent liver concentrates by Elvehjem and associates in 1937. In the dry state it is a very stable compound, and unlike some other members of the B complex it is even stable to alkali. It was renamed niacin instead of nicotinic acid because it had none of the physiologic properties of nicotine found in tobacco.

Two forms of this vitamin, niacin

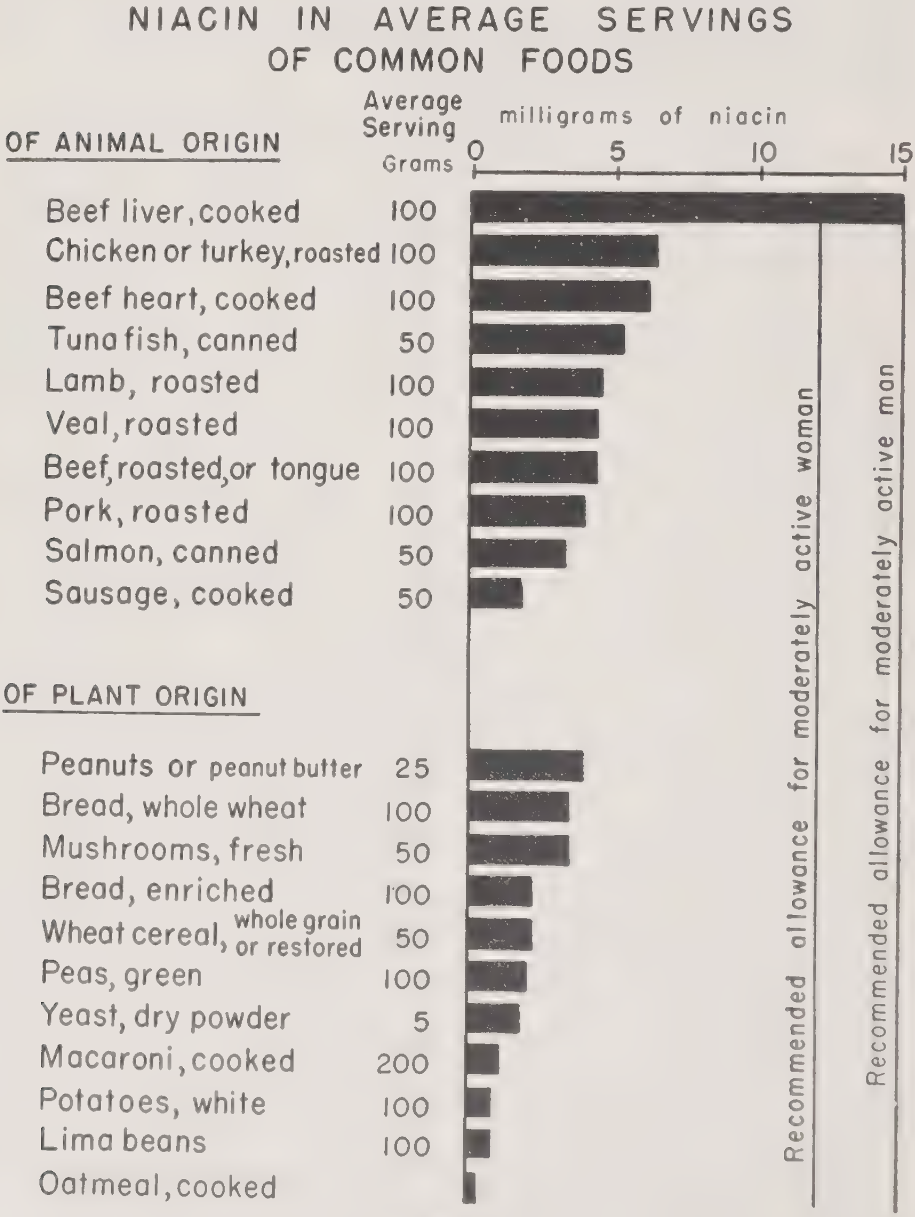

Fig. 24.

and niacinamide, have antipellagra activity. Therapeutic doses of niacin may cause temporary flushing or hot flashes, but niacinamide does not produce this reaction.

Units and Methods of Assay. Niacin in foods and niacin requirement are both expressed in milligrams of the pure chemical substance.

A microbiologic method for niacin assay is now generally used in place of animal assays. Dogs were the only animals with which early bio-assays could be made and such tests were based upon the blacktongue-preventing value.

Human Requirement. Evidence on the human requirement for niacin is rather meager. Most of the clinical evidence is based upon doses of niacin effective in the cure of pellagrous symptoms, and it is well known that curative doses are usually much larger than preventive ones. It has been assumed that niacin requirement may vary with energy expenditure, as seems to be true with other members of the B complex that function in tissue respiration. The Food and Nutrition Board recommendation of from 12 to 20 mg. for men and from 11 to 15 mg. for women are the best estimates possible at the present time, but they are subject to revision as more data become available.

Food Sources. Meat, poultry and fish are in general better sources of niacin than plant products, as emphasized in Figure 24, showing average servings. Whole-grain and enriched products make an appreciable contribution because they are usually consumed in generous amounts. Fruits and vegetables other than mushrooms and legumes are insignificant sources of niacin. Milk and eggs are poor sources. (See Fig. 24.)

PANTOTHENIC ACID

Physiologic Significance. Pantothenic acid, earlier known as filtrate factor, yeast growth factor or chick antidermatitis factor, is another of the vitamin B complex group. It is essential for the well-being of rats, dogs, pigs and pigeons, as well as chicks, but its specific function is not well understood. A deficiency of pantothenic acid may be manifest by emaciation, loss or graying of the hair in dark animals, ulcers of the intestinal tract, tissue dehydration, damage to adrenal, kidney or heart tissue and a special type of nerve degeneration that results in a goose-step gait.

Clinical observations indicate that it may be essential to human nutrition, but its function is not yet clearly defined. It may be associated with riboflavin in the normal functioning of tissue enzymes, and is probably stored in the liver and, to a lesser extent, in the kidneys and other organs. No figure for human requirement has been agreed upon, but research workers in this field have suggested that the requirement may not be far from 5 mg. daily.

Chemical Nature and Properties. The complete synthesis of pantothenic acid was accomplished in 1940 by the joint efforts of several groups of workers. It is an organic acid usually isolated in the form of its calcium salt, in which form it is a white fluffy powder, odorless, slightly bitter in taste and readily soluble in water. It is less stable to heat in the dry form than in aqueous solution, but is readily decomposed by strong alkalis or acids.

Units and Methods of Assay. Food values are usually expressed in milligrams or micrograms of the pure substance. Microbiologic methods of assay are now in general use, largely replacing growth experiments with chicks formerly used for assay.

Food Sources. The name pantothenic, meaning widespread, indicates that the distribution of this vitamin is extensive. Since assay methods have only recently been developed, figures on the pantothenic-acid content of foods are limited in number.

Yeast, liver, kidney, heart, salmon and eggs are the best sources. Other good sources are broccoli, mushrooms, pork, beef tongue, peanuts, wheat, rye and soybean flour. About one half of the pantothenic acid is lost in the milling of grains, which constitute an important, if not a rich, source of this factor in the average diet. Fruits are relatively poor sources of this vitamin.

PYRIDOXINE (VITAMIN B_6)

Physiologic Significance. The pellagra-like disease (acrodynia) in rats is recognized as being caused by a deficiency of pyridoxine. Rats also appear to utilize their food more effectively when the intake of this vitamin is adequate. Microcytic anemia develops in dogs fed on a diet deficient in this factor. Convulsions have been observed in dogs, in rats and in pigs deprived of pyridoxine. Although its physiologic significance is not well understood, its chemical structure indicates that there is a probable connection with tissue oxidation. There is also some evidence that it is concerned with the utilization of unsaturated fatty acids. The role of this factor in human nutrition is not well established, although it seems to be essential.

Chemical Nature and Properties. Pyridoxine is a white crystalline powder, salty in taste, stable to acid and alkali, relatively stable to heat and very soluble in water. The potency is expressed in micrograms or milligrams of pure pyridoxine hydrochloride.

Food Sources. Of the animal foods, pork and the glandular meats are the richest, with lamb and veal relatively better than fish or beef muscle. Milk and eggs are poor sources. Of the plant food, legumes, potatoes, oatmeal, wheat germ and bananas are the richest, with cabbages, carrots and other vegetables providing fair amounts. The pyridoxine content of foods is determined by a microbiologic method. This method has only recently been developed, consequently only a few foods have been assayed so far.

BIOTIN

Physiologic Significance. Biotin, one of the newer members of the vitamin B complex, was first isolated in 1936 as a growth essential for yeast. Its formula was determined in 1942.

Previous to these dates numerous workers had described factors called by various names but having similar antidermatitis properties. These several "factors" proved to be identical; thus "bios," "vitamin H," "protective factor X" and the "factor protective against egg-white injury" became biotin. Investigations have shown that a biotin deficiency in rats can be induced by the inclusion of large amounts of raw egg white in the diet. Rabbits and monkeys also exhibit characteristic dermatitis when fed diets rich in egg white. Avidin, a protein-like substance, has been established as the biotin-inactivating factor in raw egg white. The biotin becomes unavailable by virtue of being tied up with avidin, thereby forming a complex compound incapable of absorption from the intestinal tract. Chicks and turkeys exhibit characteristic dermatitis even when not fed egg-white diets. A group of investigators have reported observations that indicate the possible significance of biotin in human nutrition.

Chemical Nature and Properties. Biotin is a very stable compound and in the form found in nature is resistant to heat, mild alkali and strong acids. Pure biotin is inactivated by oxidizing agents and strong alkali. Biotin is active in all growing cells and is present in lesser concentration than are most other vitamins. For this reason it is usually measured in micrograms.

Food Sources. Satisfactory microbiologic assay methods are now available for biotin, but as yet relatively few foods have been analyzed for this factor. It is abundant in liver and other organs, in yeast, mushrooms and peanuts. Lesser amounts occur in milk, eggs and certain vegetables and fruits.

Para-Aminobenzoic Acid

Para-aminobenzoic acid was first recognized as a vitamin in 1941. However, it had long been known as a simple chemical derivative of benzoic acid. A deficiency of this factor has resulted in the graying of hair of dark-colored rats and other animals. Some laboratories have reported an interference with normal pregnancy and lactation, but not with growth.

A microbiologic assay method was developed in 1942, but relatively few foods have been analyzed.

Favorable results were obtained in treating a group of sterile women with para-aminobenzoic acid therapeutically, but much more clinical experience is needed before its human significance is understood.

Inositol

Inositol was first considered to be a vitamin in 1940, although it had been known for decades as a carbohydrate substance with an empirical formula the same as glucose. It has a sweet taste and is stable to strong acids and alkalis. It occurs in plants as phytin, a calcium-magnesium salt of inositol phosphoric acid. Inositol is also found in certain animal tissues, but relatively little is known of its function and nothing regarding its human significance.

Food sources are fruits, vegetables, whole grains and the meats of certain organs.

Choline

Choline has been known for decades as an essential component of animal tissues, but only recently has it been considered as a vitamin and classed with the B complex. This classification is still questioned by several workers. A choline deficiency may result in liver damage, "fatty liver," hemorrhagic degeneration of kidneys in young rats, perosis in chicks and in turkeys, and failure of normal lactation in rats and paralysis in the suckling young. Its function seems to be closely associated with other members of the B complex, and without it normal conversion of carotene to vitamin A and storage in the liver are inhibited. Choline is widely distributed in plant and in animal tissues, and a deficiency is not likely in average diet.

Folic Acid

Several workers have found simultaneously a new fraction of the vitamin B complex to be effective in relieving a characteristic syndrome in experimental animals. The term most commonly applied to this factor is folic acid, because it is found abun

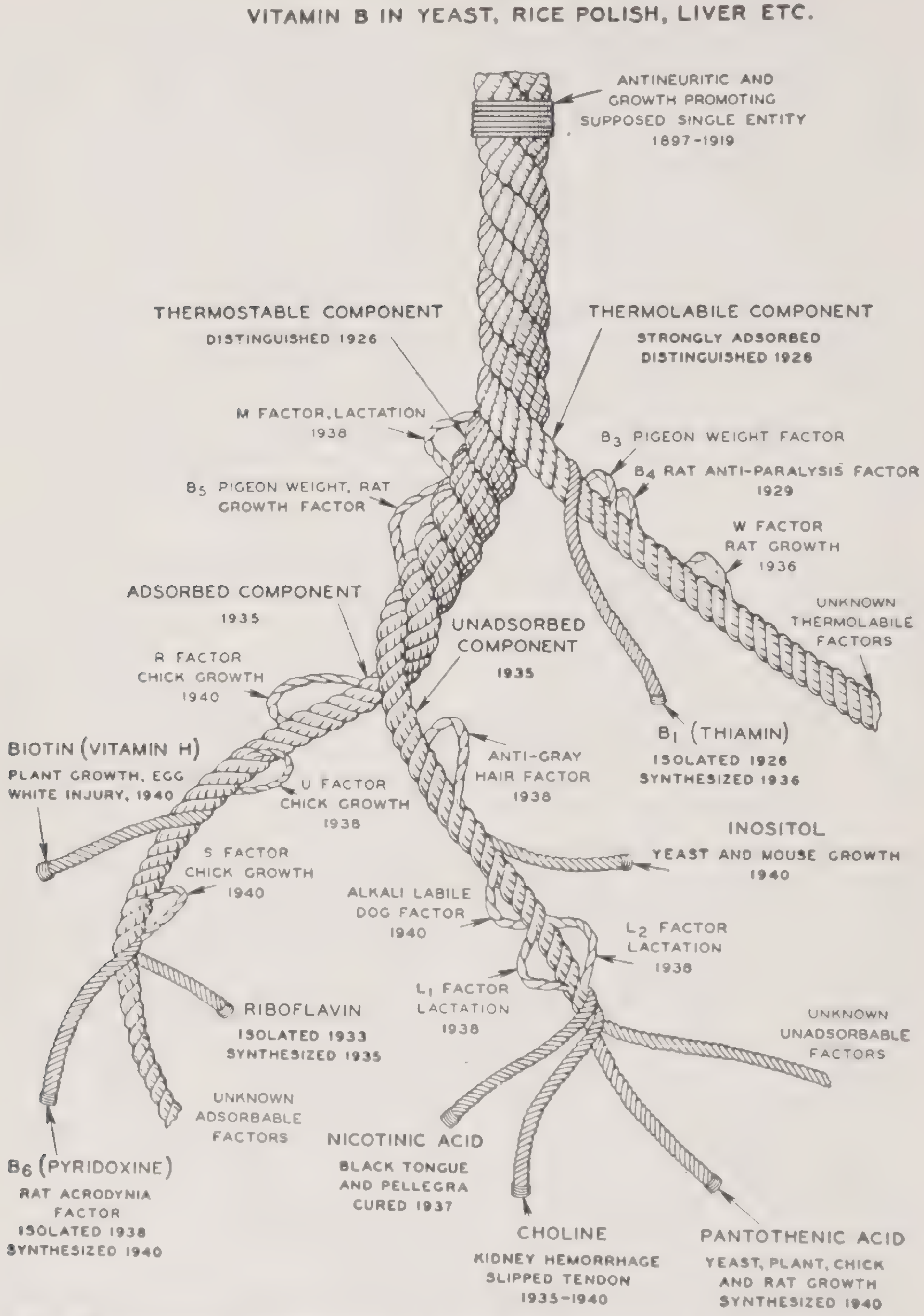
VITAMIN B IN YEAST, RICE POLISH, LIVER ETC.
ANTINEURITIC AND GROWTH PROMOTING SUPPOSED SINGLE ENTITY 1897-1919
THERMOSTABLE COMPONENT DISTINGUISHED 1926
THERMOLABILE COMPONENT STRONGLY ADSORBED DISTINGUISHED 1926
M FACTOR, LACTATION 1938
B_3 PIGEON WEIGHT FACTOR
B_4 RAT ANTI-PARALYSIS FACTOR 1929
B_5 PIGEON WEIGHT, RAT GROWTH FACTOR
W FACTOR RAT GROWTH 1936
ADSORBED COMPONENT 1935
UNKNOWN THERMOLABILE FACTORS
UNADSORBED COMPONENT 1935
R FACTOR CHICK GROWTH 1940
B_1 (THIAMIN) ISOLATED 1926 SYNTHESIZED 1936
BIOTIN (VITAMIN H) PLANT GROWTH, EGG WHITE INJURY, 1940
ANTI-GRAY HAIR FACTOR 1938
U FACTOR CHICK GROWTH 1938
INOSITOL YEAST AND MOUSE GROWTH 1940
S FACTOR CHICK GROWTH 1940
ALKALI LABILE DOG FACTOR 1940
L_2 FACTOR LACTATION 1938
L_1 FACTOR LACTATION 1938
RIBOFLAVIN ISOLATED 1933 SYNTHESIZED 1935
UNKNOWN UNADSORBABLE FACTORS
UNKNOWN ADSORBABLE FACTORS
NICOTINIC ACID BLACK TONGUE AND PELLEGRA CURED 1937
B_6 (PYRIDOXINE) RAT ACRODYNIA FACTOR ISOLATED 1938 SYNTHESIZED 1940
CHOLINE KIDNEY HEMORRHAGE SLIPPED TENDON 1935-1940
PANTOTHENIC ACID YEAST, PLANT, CHICK AND RAT GROWTH SYNTHESIZED 1940

FIG. 25. Schematic representation of the various components of the vitamin B complex up to 1940. (R. R. Williams, Bell Telephone Laboratories.)

dantly in green leaves (hence its name—folium, meaning leaf). The experimental syndrome includes poor growth and various types of anemias in the chick and the monkey. The need for folic acid in humans has not been established, but some preliminary reports from several groups of workers [9] indicate encouraging results in the treatment of certain types of human anemias, particularly macrocytic anemia associated with sprue. The synthetic form was more effective than the crude concentrates from natural sources.

OTHER FRACTIONS OF THE VITAMIN B COMPLEX

Vitamins B_3, B_4, B_5, factors L_1 and L_2, U and W, have all been described as essential for growth or protection against specific lesions in experimental animals, but as yet they have not been generally accepted. Nothing is known of their human significance. If an adequate intake of the better-known B complex vitamins is derived from natural sources, it can be assumed that those less well known will be present. The confusion that accompanies the discovery of most new vitamins until their identity is well established need not concern the average reader of this text. Still other factors postulated in Figure 25 are not discussed here.

OTHER VITAMINS

Vitamin P (citrin) was reported in 1936 as another substance besides ascorbic acid present in paprika. Other workers have proposed that certain foods rich in ascorbic acid contain a factor that affects the permeability of blood vessels involving more than can be explained in terms of ascorbic acid. These observations led to the isolation from lemon juice and rind of the substance now called citrin. Some further clinical studies show that citrin has a definite effect in improving low capillary resistance and certain hemorrhagic conditions.

Investigations of two groups of workers indicate the presence in fresh-leaf juices of pasture grasses, cabbage, lettuce and probably other plants of a factor different from any other recognized. It has been reported that this "grass-juice" factor has some function in reproduction of certain animals.

REVIEW QUESTIONS

1. The history of vitamin discoveries includes both clinical findings and laboratory experiments. If a clinical condition in man is similar to an experimental deficiency in an animal, how can it be proved that the human condition is nutritional?

2. Some vitamins are stored in body tissues to a greater extent than others. If a group of explorers were short of foods providing vitamins A, C and D, which deficiency might be expected to show up first?

3. Vitamin A is derived from carotene and other yellow plant pigments. Does the depth of yellow color in butter and in eggs indicate the vitamin A potency? Why or why not?

4. There are at least 12 fractions of the vitamin B complex recognized at present. If a new factor is discovered, what determines whether it belongs to this "family" of vitamins?

5. The stability of the vitamins to several destructive agents varies widely. What vitamins are likely to be destroyed under the following conditions: (A) Milk exposed to sunlight. (B) Cabbage kept overnight after shredding. (C) Wheat germ

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[9] Spies, Tom: J.A.M.A. 130:474, 1946.

SUMMARY OF

	A	D	E	K	C
Chemical name	(Provitamin) Carotene	Calciferol	Tocopherol	Menadione	Ascorbic acid
Descriptive name	Antiophthalmic	Antirachitic	Antisterility	Antihemorrhagic	Antiscorbutic
Important food sources	Liver Egg yolk Butter, cream Green and yellow vegetables Fish-liver oil	Fish-liver oil Irradiated foods Viosterol Butter Egg yolk Liver	Wheat germ Leafy vegetables Vegetable oils Egg yolk Legumes Nuts	Leafy vegetables Pork-liver fat Soybean oil and other vegetable oils	Citrus fruits Strawberries Cantaloupe Tomatoes Sweet peppers Cabbage Potatoes
Stability to cooking, drying, light, etc.	Gradual destruction by exposure to air, heat and drying more rapid at high temperatures	Stable to heating, aging and storage Destroyed by excess ultraviolet irradiation	Stable to all methods of food processing Destroyed by rancidity and ultraviolet irradiation	Stable to heat, light and exposure to air Destroyed by strong acids, alkalis and ox. agents	Unstable to heat and oxidation, except in acids Destroyed by drying and aging
Deficiency manifest as	Night blindness Glare blindness Rough, dry skin Dry mucous membranes	Rickets Soft bones Bowed legs Poor teeth Skeletal deformities	Sterility in males (rats) Resorption of fetus (females) Muscular dystrophy in rats and rabbits	Slow clotting time of blood Hemorrhagic disease of newborn Lack of prothrombin	Scurvy Sore mouth Stiff joints Sore and bleeding gums Weak-walled capillaries
Experimental animals used	Rats Chickens Cattle	Rats, dogs Calves Chickens	Rats Rabbits	Chicks Rats	Guinea pigs Monkeys
Assay methods	Bio-assay (rats) Colorimetric	Bio-assay (rats)	Bio-assay (rats)	Bio-assay (chicks)	Chemical
Units	I.U.	I.U.	Mg.	Mcg.	Mg.
Adult human requirement	5,000	Children and adolescents, 400-800	Unknown	Unknown	70-75 Mg.

VITAMINS

Fractions of the Vitamin B Complex

Thiamine (B_1)	Riboflavin (B_2)	Niacin	Pantothenic Acid	Pyridoxine	Biotin
Antineuritic Antiberiberi		Pellagra-preventive	Antidermatitis	Antiacrodynia	
Pork Liver, meats of organs Whole grains Enriched products Nuts, legumes Potatoes in skins Yeast, wheat germ	Liver, milk Meats, eggs Enriched bread Green, leafy vegetables Yeast	Liver, poultry Meat, fish Whole grains Enriched products Legumes Mushrooms Yeast	Liver Meats of organs Eggs, peanuts Legumes Mushrooms Salmon, whole grains Yeast, wheat germ	Pork Meats of organs Legumes, seeds Grains Potatoes Bananas, wheat germ Yeast	Liver, Meats of organs Peanuts, eggs Milk Mushrooms Yeast
Unstable to heat and oxidation	Stable to heat in cooking, to acids and oxidation Unstable to light	Stable to heat, light and oxidation, acid and alkali	Unstable to acid, alkali, heat and certain salts	Stable to heat, light and oxidation	Very stable to heat, light, acid and mild alkali Unstable to oxidation
Beriberi (man) Polyneuritis (animals) Poor appetite Fatigue Constipation	Eye sensitivity Cataract Cheilosis (man) Alopecia (rats)	Pellagra (man) Blacktongue (dogs)	Dermatitis (chicks) Graying of hair (rats)	Acrodynia (rats) Microcytic anemia (dogs)	Dermatitis in all animal species
Rats, dogs Pigeons Chickens	Rats, mice Chickens Monkeys	Dogs	Chicks, rats Dogs, pigs Pigeons	Rats Dogs Pigs	Rats, rabbits Monkeys, chicks Turkeys
Chemical Microbiologic	Chemical Microbiologic	Chemical Microbiologic	Microbiologic	Microbiologic	Microbiologic
Mg. or mcg.	Mg. or mcg.	Mg.	Mg. or mcg.	Mg. or mcg.	Mcg.
Men 1.2-2.0 mg. Women 1.1-1.5 mg.	Men 1.6-2.6 mg. Women 1.5-2.0 mg.	Men 12-20 mg. Women 11-15 mg.	Unknown	Unknown	Unknown

allowed to become rancid. (D) Vegetables to which soda has been added in cooking. (E) Potatoes mashed and reheated.

6. Since the supply of vitamin D is limited in natural foods, commercial processing is producing vitamin D foods. What process is used and what foods are commonly fortified with vitamin D?

7. Vitamin K is widely distributed in foods and is not apt to be lacking in the average diet. When may a deficiency occur and what prophylactic measures are recommended?

8. Human deficiency diseases are apt to be multiple in nature. What deficiency disease common in southern United States is due to a multiple deficiency and what are the specific vitamins concerned?

9. Scurvy is one of the oldest deficiency diseases known but it is relatively rare in the United States today. Where does it occur and when? What vitamin is involved, and is there evidence of mild deficiency of it in this country?

10. Using the basic dietary pattern as outlined in Chapter 2, calculate the contribution made by each of the food groups toward the day's requirement for each of the following vitamins: Vitamin A, thiamine, riboflavin, niacin and ascorbic acid. (Follow style of similar table showing contribution of calcium and iron, page 63.)

9

Water and Vegetable Fiber

Chapter Topics

- WATER
  - WATER IN RELATION TO THE BODY
  - DRINKING WATER
- VEGETABLE FIBER
  - FUNCTION OF FIBER IN THE INTESTINES
  - FIBER AND CONSTIPATION

Water and vegetable fiber are entirely different when considered in the light of their physical and chemical properties; nevertheless, they have some physiologic functions in common. They function mechanically as bulk in the digestive tract. Vegetable fiber resists digestion and absorption to any extent and is excreted as such in the stools: water, which requires no digestion, is retained in part until the food mass reaches the colon and part is absorbed into the blood stream. However, they are considered separately in this chapter.

WATER

Water in Relation to the Body

Water is even more essential to life than food, since man may live for several weeks without food, but only for a few days without water. This simple chemical compound is an essential part of every cell in the body as well as of the fluid tissues. Its chemical composition is very simple, being composed of only two elements, hydrogen and oxygen, in the proportion of two parts of hydrogen to one of oxygen. It boils at 212° F. or 100° C. at sea level, and it freezes at 32° F. or 0° C. It has no fuel value and it is not affected in any way by the digestive juices, but is absorbed in its original form.

The importance of water to the body is shown by the fact that approximately two thirds of the body weight is made up of it. Thus an average man has about 100 pounds of water in his body composition. About four and one half pints are eliminated every 24 hours, thus necessitating the daily replacement of this quantity. A portion of this necessary amount is taken each day in combination with food, since practically all foods contain some water and many of them, particularly fruits and vegetables, contain as high as 90 per cent (see Fig. 27). Although some water (about ¾ pint) is formed within the body as an end product of combustion of foodstuffs, from six to eight glasses of water or other beverages should be drunk daily in order to make sure that a sufficient amount of water is available for bodily functions. Formerly, the drinking of water with

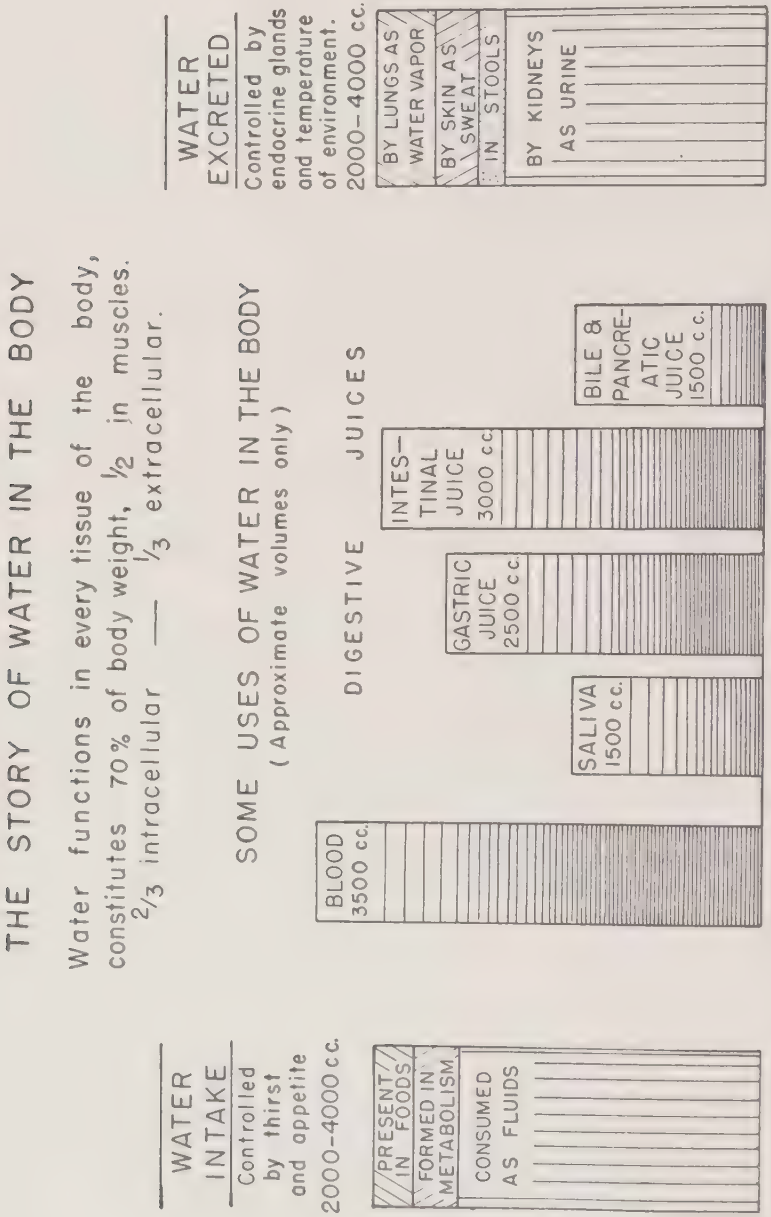
THE STORY OF WATER IN THE BODY
Water functions in every tissue of the body, constitutes 70% of body weight, 1/2 in muscles.
2/3 intracellular — 1/3 extracellular.
WATER INTAKE
Controlled by thirst and appetite
2000–4000 cc.
PRESENT IN FOODS
FORMED IN METABOLISM
CONSUMED AS FLUIDS
SOME USES OF WATER IN THE BODY
(Approximate volumes only)
DIGESTIVE JUICES
BLOOD 3500 cc.
SALIVA 1500 cc.
GASTRIC JUICE 2500 cc.
INTES-TINAL JUICE 3000 cc.
BILE & PANCRE-ATIC JUICE 1500 cc.
WATER EXCRETED
Controlled by endocrine glands and temperature of environment.
2000–4000 cc.
BY LUNGS AS WATER VAPOR
BY SKIN AS SWEAT
IN STOOLS
BY KIDNEYS AS URINE

Fig. 26.

meals was thought to be a hindrance to digestion, but recent tests contradict this. However, it is wise to be moderate in the amount taken with meals and not to use it as a means of washing down food which has not been properly masticated. Water taken before breakfast in the morning may act as a mild laxative. The laxative effect may be increased by taking water plus a small amount of salt, which hinders absorption and tends to retain the water in the intestine, thus softening any accumulated food residues. Normally enough water is retained with food residues to produce a soft stool.

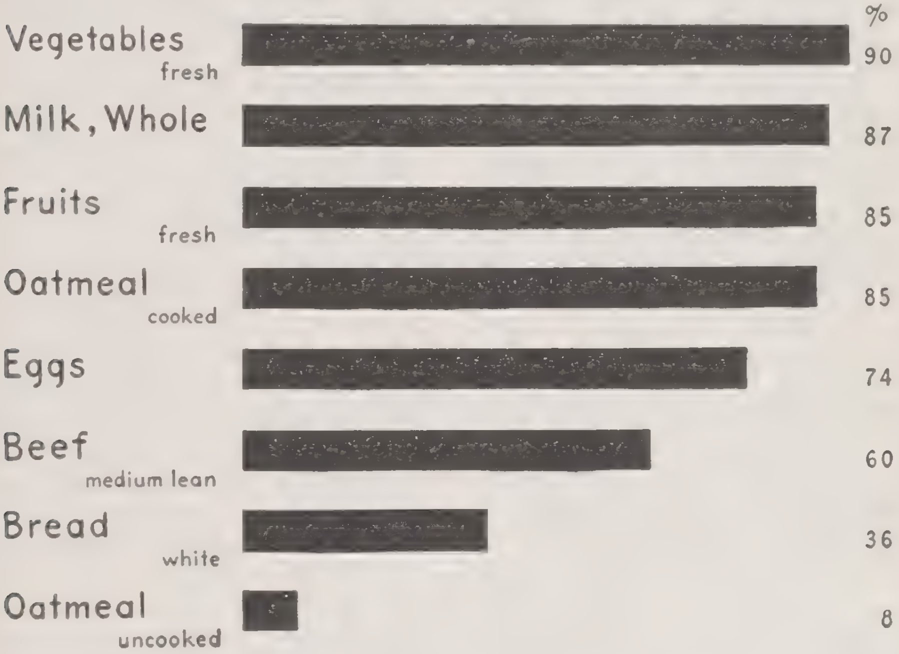

FIG. 27. Percentage of water in common foods.

Water in Body Fluids. Water is essential as a component part of blood, lymph and the secretions of the body, as well as of the more solid tissues. Water is the preferred medium in which the various chemical changes of the body take place. As a carrier it aids in digestion, absorption, circulation and excretion; it is essential in the regulation of body temperature; it plays an important part in the mechanical functions, such as lubrication of joints and movement of the viscera in the abdominal cavity. Moisture is necessary for the functioning of every organ in the body. Waste products from the tissues are transferred to the blood in watery solutions; they are carried by the blood, which is about 90 per cent water; they are excreted via the kidneys in the urine, which is about 97 per cent water. (See Fig. 26.)

The conservative use of water by the body has been discussed by Cannon.[1] Thus about 1½ quarts of saliva, 2 quarts or more of gastric juice, 4 quarts or more of bile, pancreatic and intestinal juices, each composed almost

[1] Cannon, W. B.: The Wisdom of the Body, New York, Norton, 1932.

wholly of water, are discharged daily into the alimentary canal and are practically all absorbed again from the intestines. Thus the water which carries the active enzymes into the digestive tract aids in carrying the digested food into the tissues during the process of absorption. In the kidney again large volumes of water carry the dissolved waste material through the capsule of the uriniferous tubules, but in passing through the tubules part of the water with some of its useful dissolved material is reabsorbed.

Dehydration. The fatal results of extreme thirst and dehydration (loss of water) further emphasize the importance of water. The German physiologist Rubner states that we can lose all our reserve glycogen, all reserve fat and about one half of the body protein without great danger, but that a loss of 10 per cent of the body water is serious and from 20 to 22 per cent loss is fatal. Thirst is nature's device for ensuring an adequate water intake. Thirst is a sensation of dryness at the root of the tongue and back part of the throat. Normally thirst is experienced when breathing dry air, eating dry food, after exercise or after prolonged speaking or singing. Any circumstance that tends to increase water elimination, such as profuse sweating, hemorrhage, diarrhea or increased volume of urine, as in diabetes, will create intense thirst. The use of common salt to stimulate thirst and increase water consumption has already been discussed in Chapter 7.

Drinking Water

Purity. It is essential indeed that drinking water should be pure. Most cities take pride in a good water supply that comes from a pure source and that is usually filtered and often treated chemically, e.g., with chlorine, before it is turned into the water mains for public consumption. Water which is doubtful in character should be boiled before using. Distilled water is, of course, water in its purest form. However, it is not palatable for drinking, and it is doubtful if it is any more wholesome than water with a moderate degree of hardness or mineral constituents. There is some ground for believing that the salts of medium hard water may be utilized by the body, but mineral waters containing a high percentage of salts, such as are found in some noted mineral springs, are of questionable value. However, recent experiments seem to show that certain iron-containing waters may be beneficial. Mineral waters should never be used except on the advice of a physician, for they may be decidedly harmful. Mineral water is usually named from the element found most abundantly in it, such as sulfur, iron or magnesium water. It is usually necessary to drink large quantities in order to get a medicinal dose of the salt. Many consider that the chief benefit comes from the imbibing of large quantities of the water rather than from the mineral contained therein. There are many varieties of bottled water on the market. Some of these are merely "spring" water, others distilled water to which a certain percentage of mineral salts has been added, and still others, mineral waters of a high percentage of salts. Whatever the content may be, the user should be assured of the purity from a bacteriologic standpoint.

Aerated waters may be natural or artificial. They are sometimes obtained from springs that send forth water charged with carbon dioxide gas. Artificially aerated waters are produced by charging with this gas, which is usually made from limestone or from the action of an acid upon marble or chalk. Carbon dioxide gas seems to have a stimulating effect upon digestion, probably because it increases motility of the stomach and because the bubbles break up the food mass so that it is more quickly mixed with the digestive juices. Aerated waters are sold bottled, simply as such, or, more commonly, as flavored preparations, such as ginger ale and similar beverages. Many of these preparations are artificially colored. They contain a small amount of sugar, which gives them their sweet flavor and which forms their slight nutritive value.

VEGETABLE FIBER

Cellulose and hemicellulose, which together are known as fiber, form the framework of the vegetable world. They are the chief constituents of wood, of the stalks and the leaves of all plants, and provide the outer coverings for seeds. Fiber forms the more or less porous walls of plant cells in which are stored water, starch, minerals, etc., much as honey is held in the comb.

The Story of Fiber in the Body

IN FOOD	IN THE DIGESTIVE TRACT	IN EXCRETA
Cellulose	*Functions Chiefly as Bulk*	*Indigestible Residue*
in Vegetables Fruits Cereals Nuts	Softened by digestive juices Stimulates peristalsis Small fraction digested by bacterial action and absorbed as glucose Largest proportion undigested passes into large intestine	in Stools

Fiber furnishes little if any food value in the human body but may be valuable for its mechanical effect in the digestive tract. It is usually considered an indigestible substance, but many individuals apparently utilize some of the more tender celluloses from green leaves and young shoots. No enzyme secreted by the body can digest cellulose, but bacterial enzymes in the intestines may play a role in its disintegration, dissolving the substances that bind the cellulose fibers together.

While it is likely that different species of animals vary in their ability to utilize cellulose, it is interesting to note that in rats the ingestion of cellulose increases the dry weight of the feces beyond the amount that can be attributed to the undigested cellulose alone. This finding has been interpreted to indicate that fiber interfered with the complete digestion of other foods.

Function of Fiber in the Intestines

The indigestibility of fiber is its major asset as it furnishes the bulk necessary for efficient peristaltic action. Without some indigestible food residue the most normal colon may have difficulty in maintaining a proper degree of motility. Because of the overrefinement of many present-day foodstuffs, with the consequent lack of sufficient bulk to produce adequate peristaltic action, the addition of cellulose in the form of bran or agar-agar to the diet is sometimes necessary for maintaining normal intestinal action. On the other hand, persons who tend to have spastic constipation or nervous indigestion may have to limit the amount of bulk. There is apparently wide variation in the amount of fiber tolerated or needed by different persons.

Investigations on humans conducted by Cowgill[2] at Yale and by Rose[3] at Columbia have demonstrated in a convincing manner that the normal colon performs better when a reasonable amount of bulk or residue is present. Figures are given as to the amount of fiber that a normal person requires per day. Thus 90 mg. per Kg. of body weight or 6.3 Gm. per person per day have been suggested as an average adequate allowance, to be increased or reduced as the individual idiosyncrasies indicate.

In order to make a quick, rough estimate of the fiber content of the diet, Stern[4] suggests the following averages:

Vegetables and fresh fruits:
  1 Gm. of fiber/100 Gm. (average serving)
Dried fruits:
  1.5 Gm. of fiber/30 Gm. (average serving)
Whole-grain bread and cereals:
  0.5 Gm. of fiber/30 Gm. (average serving)
Nuts:
  0.5 Gm. of fiber/30 Gm.

(For more accurate figures on fiber content of common foods, see Table 1, Part Four.)

The degree of digestibility of cellulose varies according to the stage of growth and the type of plant that yielded it. The cellulose of tender shoots of leaves may disappear quite completely from the intestinal tract.

FIBER AND CONSTIPATION

Constipation. Cowgill[5] found that in cases of simple constipation the fraction of the fiber of the basal diet and of fruits and vegetables that remained intact after passage through the alimentary tract was much less than was the case with healthy men. He suggests that the tendency to constipation that these patients exhibited may be due to this fact. Later work[6] seems to indicate an inherent difference in the laxative of action of fiber from different food sources. Some factor other than fiber content may be responsible for the bulk-forming properties and resulting laxation of certain foods such as bran. In general the more mature the plant from which the cellulose is obtained the tougher the fibers and the more resistant to digestion. For example, bran, the outer coat of the ripe grain, passes through the digestive tract practically undigested.

In addition to cellulose as it is found in ordinary foodstuffs, there are substances of a somewhat similar nature, such as Irish moss, agar-agar and psyllium seed. Agar-agar is a hemicellulose preparation from seaweed, soluble in hot water and forming a gelatinous mass on cooling. It is sometimes useful in a laxative diet, since it has the ability to absorb and hold several times its volume of water, thus producing and maintaining the necessary increase in bulk and at the same time tending toward the formation of large soft stools. Psyllium seed also absorbs and retains a large amount of water with the additional feature that its slimy outer covering may act as a lubricant as well.

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[2] Cowgill, G. R., *et al.*: J.A.M.A. **98**:1866, 1932; **101**:273, 1933.

[3] Rose, M. S., *et al.*: J. Am. Dietet. A. **8**:133, 1932.

[4] Stern, F.: Applied Dietetics, Baltimore, Williams and Wilkins, 1943.

[5] Cowgill, *op. cit.*

[6] Hoppert, C. A. and A. J. Clark: J. Am. Dietet. A. **21**:157, 1945.

Green vegetables and fresh fruits, cereals from which the outer coat has not been removed in the milling process and dried fruits are good natural sources of cellulose, and should be used as liberally as possible in the diet.

REVIEW QUESTIONS

WATER

1. Life can be maintained longer without food than without water. Why are shipwrecked men warned never to drink sea water?

2. Water is ingested both in food and in drink and makes up about two thirds of the body weight. How will the environmental temperature alter the channel of water excretion?

3. Water is essential to most metabolic processes in the body. How can seven to nine quarts of digestive juices be secreted daily with a water intake of between one and two quarts?

4. Most communities in this country provide an adequate supply of safe drinking water. What precautions should be taken when traveling in areas in which the purity of the water is not ensured?

5. Natural mineral waters are of doubtful therapeutic value. Why are beneficial results often wrongly attributed to them?

FIBER

1. Fiber is the term often applied to the indigestible carbohydrate of plant foods. What are these carbohydrates and how do they differ in various types of plants?

2. The chief value of fiber is to furnish bulk in the intestine. Would you expect an individual with nervous indigestion and a tendency to spastic constipation to require as much bulk as one with atonic constipation? Why or why not?

3. Many fresh fruits and vegetables of high water and fiber content are rich in certain vitamins and minerals. Which vitamins are apt to be found in this type of foods? List ten such foods.

4. What classes of foods are high in fiber content but low in water? What types of minerals and vitamins are apt to be found in such foods. List five such foods.

10

Digestion, Absorption and Cell Metabolism

Chapter Topics

- DIGESTION AND ENZYMES
- FOOD CHANGES IN THE MOUTH
- DIGESTION IN THE STOMACH
  - HOW FOODS LEAVE THE STOMACH
- DIGESTION IN THE SMALL INTESTINE
- SUMMARY OF DIGESTIVE JUICES AND THEIR ENZYMES
- ABSORPTION OF FOOD
- FOOD CHANGES IN THE LARGE INTESTINE
- FACTORS AFFECTING DIGESTION
  - CELLULOSE AND DIGESTION
- CELL METABOLISM

DIGESTION AND ENZYMES

A brief review of the subject of digestion cannot well be omitted from the study of nutrition. For a more detailed discussion of the subject of food digestion and absorption than the following, reference may be made to any up-to-date textbook on physiology.

Digestion is the process whereby foods are prepared by the various parts of the alimentary canal for absorption into the body proper. No food can function in nourishing the body tissues until it has been absorbed into the blood stream. Before food can be absorbed it must undergo a series of mechanical and chemical changes that constitute digestion. The chemical changes are brought about by a series of enzymes secreted by various glands in or near the digestive tract. These enzymes or chemical ferments are capable of accelerating the breaking down of complex foodstuffs into simpler compounds. Enzyme action is specific; that is, a particular enzyme functions in the breakdown of a particular class of foodstuffs and has no action on any other. Digestion experiments performed outside the body, although not exactly duplicating body conditions, have served to demonstrate the high degree of specificity as well as the great activity of enzymes.

Enzymes may digest from 500,000 to 4,000,000 times their own weight of the foodstuffs in question. The enzymes are unstable at high temperatures; since they undergo decomposition when kept in solution outside the body, they are usually prepared for experimental work in dry or powder form. Most of them function best at body temperature and under the specific conditions provided in given regions of the normal digestive tract. Enzymes are most appropriately named to indicate the substances upon which they act, using the ending -ase. For example, amylases (amyl, starch), proteases (protein), lipases (lipin, fat) and disaccharidases (the double sugars, maltose, etc.). Specific enzymes act on each sugar; maltase on maltose, sucrase on sucrose, etc.

FOOD CHANGES IN THE MOUTH

The first change in food takes place in the mouth, where it is finely divided through the process of mastication, softened, moistened and made ready for swallowing. It is moistened by becoming mixed with saliva, a fluid secreted by three pairs of glands: the submaxillary, located near the angle of the jaw; the sublingual, beneath the tongue; and the parotid, in the cheek. It has been estimated that these glands secrete about 1,500 cc. of saliva per day, a little more than three pints. The most active principle of the saliva is a salivary amylase—ptyalin—an enzyme that acts on starch. Ptyalin carries the digestion of the cooked starch through three or more dextrin stages down to the sugar maltose. The possibility that maltose may be changed to glucose by a salivary maltase has been suggested by some workers. However, the complete change of starch to either maltose or glucose seldom occurs in the mouth, since food remains there only a few minutes.

Swallowing is a reflex act initiated by the muscles at the base of the tongue. The bolus of food is carried down the esophagus partly by gravity and partly by muscular action—a wave of relaxation followed by a wave of constriction (peristalsis), the entire process taking only a few seconds

DIGESTION IN THE STOMACH

The food as it enters the stomach forms a mass in the fundus, the portion nearest the esophagus that serves as a reservoir for food. Here it is held for some time, variously estimated at from one half to two hours, during which time little or no free hydrochloric acid mixes with it, since the glands producing the acid are situated in the middle portion of the stomach. The salivary digestion of starch proceeds until such time as the food mass, which is neutral or slightly alkaline upon entering the stomach, has become permeated with the acid gastric juice. The food mass in the fundus is gradually reduced in size as small portions move toward the middle portion of the stomach, where active gastric digestion proceeds.

Gastric juice is a clear liquid, the active principles of which are hydrochloric acid and a gastric protease—pepsin—rennin and a gastric lipase. From 2,000 to 2,500 cc. of gastric juice are secreted daily. Hydrochloric acid is present in the juice in about 0.4 or 0.5 per cent concentration when freshly secreted from the glands. Some of the acid is neutralized by alkaline fluids regurgitated from the small intestine. Therefore the juice as it is obtained from the stomach contains about 0.2 per cent hydrochloric acid, which is diluted still further when food is present. In abnormal conditions the acid may be increased, reduced or absent. The acid probably serves to delay or inhibit the growth of some of the micro-organisms that find entrance into the stomach along with the water and the food. This inhibiting value must not be overemphasized, because it is limited by the short time the food is in contact with the acid.

Gastric Enzymes. The gastric protease—pepsin—is formed by the action of hydrochloric acid on the inactive form of the enzyme known as pepsinogen. Pepsin changes proteins into the simpler forms, proteoses and peptones. This peptic action is continued for a short time after the food reaches the intestinal tract. Rarely, if ever, is the quantity of pepsin insufficient for the digestion of the proteins, but the amount of hydrochloric acid secreted may be insufficient to activate the pepsinogen. Rennin, another enzyme of the gastric juice, brings about the curdling of milk (Anglo-Saxon, gerinnen, to curdle). It is a coagulating enzyme that acts upon the casein, one of the protein constituents of milk, preparing it for the further action of the protein-splitting enzymes in the intestine. A gastric lipase, the presence of which was formerly questioned, splits the emulsified fats, such as are found in cream and in egg yolk, to fatty acids and glycerol.

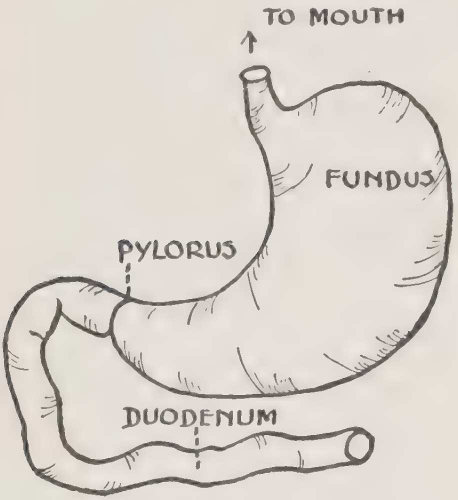

Fig. 28. Stomach showing fundus where food is first held. Note the pylorus at the entrance to the duodenum.

How Foods Leave the Stomach

Peristaltic waves, the rhythmic contractions of the alimentary tract, which begin at the transverse band near the middle of the stomach, carry the food on toward the pylorus, which in turn finally permits it to pass on into the intestinal tract. Water leaves the stomach rapidly, in one half hour or less, partly through a relaxed pylorus and partly by absorption directly from the stomach into the blood stream. Foods leave more slowly, the emptying time of the stomach varying with the individual and with the amount and the character of the meal. Small amounts of food may leave the stomach in from one to four hours, while the last remnant of a full-sized meal may not have disappeared in six or seven hours. Carbohydrates taken alone leave the stomach more rapidly than protein, and protein more rapidly than fat alone, but mixtures apparently leave more slowly than their single food constituents.

The Pylorus. When the food has become thoroughly mixed with the gastric juice, the pylorus, a strong sphincter muscle—gatekeeper of the stomach—opens more frequently and the walls of the stomach contract more vigorously so as to force the semifluid food material out into the duodenum. This material is known as chyme. The presence of acid in it causes the intestinal mucous membrane to secrete into the blood stream a substance called secretin, which in turn stimulates an outpouring of the pancreatic juice.

DIGESTION IN THE SMALL INTESTINE

Intestinal Juices. In the small intestine the food is mixed with other digestive juices, which are capable of acting upon all three of the principal food constituents, namely, carbohydrates, fats and proteins. The pancreatic juice, secreted by the pancreas, and the bile, secreted by the liver, are

STOMACH EVACUATION TIMES AND HIGHEST TOTAL ACIDITIES FOR VARIOUS ARTICLES OF DIET[1]

Article of Diet 100-gram portions unless otherwise stated	Number of Observations	Highest Total Acidity (average) (cc. 0.1 N alkali to neutralize 100 cc. juice)	Evacuation Time hours and minutes (average)
Beef and beef products	25	120	3.00
Bread and cereals	75	80	2.40
Cakes	29	90	3.00
Chicken	20	125	3.15
Egg and egg combinations	90	80	2.40
Fish	75	130	2.50
Fruits	68	90	2.00
Gelatin (fruit-juice preparations)	5	70	2.00
Guinea hen	2	110	4.00
Ice cream	7	105	3.15
Ices	4	65	2.35
Junket	4	65	2.25
Lamb and lamb products	14	135	3.00
Licorice	1	65	3.00
Milk:			
Cow:			
400 cc.	50	100	2.30
75 cc.	3	45	1.15
Human:			
150 cc.	5	60	1.40
225 cc.	2	90	2.25
Nuts (25 to 50 grams)	22	100	3.30
Orange-albumen (2:1)	2	85	2.20
Pies	29	90	2.30
Popcorn	3	60	1.30
Pork and pork products	31	120	3.15
Puddings	23	90	2.20
Sugars and candies	28	70	2.05
Turkey	2	140	3.30
Veal:			
(A) Market	7	140	2.50
(B) "Bob"	7	110	3.20
Vegetables prepared in different ways	124	75	2.15

poured into the duodenum, a short distance beyond the pylorus. The intestinal juice or succus entericus is secreted by glands in the walls of the small intestines. All three juices—the pancreatic, the bile and the intestinal—act in unison upon the chyme. They are all alkaline and their first action is to neutralize the hydrochloric acid and other acids of the food mass.

Pancreatic Enzymes in the Intestines. The enzymes in the pancreatic juice include a protease (trypsin), an amylase (amylopsin) and a lipase (steapsin), as well as a disaccharidase (maltase). Trypsin, activated by the intestinal juice, continues the digestion of proteoses and peptones or initiates the breakdown of proteins that may have escaped gastric digestion in the stomach. Trypsin is the most powerful proteolytic enzyme and may carry the splitting-off process to the amino-acid stage. The pancreatic amylase—amylopsin—continues the digestion of any starches that may not have been carried to the maltose stage by the action of ptyalin in the saliva. Even raw starches may be digested by this ferment. The pancreatic maltase acts on maltose, changing it to glucose. The pancreatic lipase—steapsin—prepares the fats for absorption by splitting the so-called neutral fat into glycerol (a kind of alcohol) and fatty acids, at the same time forming an emulsion of the fatty acids. This process is also facilitated by soaps formed by the alkali of the intestinal juice, together with the fatty acids already formed from other digested fat. The bile also acts on the fats by increasing the solubility of the fatty acids and by aiding in the formation of an emulsion, thus enabling the pancreatic lipase to come more readily into contact with the fat. The bile, therefore, facilitates both the digestion and the absorption of the fats.

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[1] Hawk & Bergeim: Practical Physiological Chemistry, Blakiston, Philadelphia. 1937.

Intestinal Enzymes. The intestinal juice contains a protease enzyme—erepsin—that carries the hydrolysis of partially digested protein to completion, breaking proteoses and peptones to amino acids. The intestinal juice completes the digestion of the carbohydrates by means of the three specific enzymes—sucrase, maltase and lactase—that split respectively sucrose (cane sugar), maltose and lactose (milk sugar) into the single sugars (glucose, fructose and galactose).

The table on this page shows the

SUMMARY OF DIGESTIVE JUICES AND THEIR ENZYMES

(See diagram on opposite page.)

Digestive Juice	Enzymes Present	Reactions Promoted
Salivary	Amylase (ptyalin)	**Starch** → **maltose**
Gastric	Protease (pepsin)	**Protein** → **proteoses** and **peptones**
	Lipase	**Emulsified fats** → **fatty acids and glycerol**
	Rennin	Aids in the digestion of milk (**casein**)
	Hydrochloric acid (not an enzyme)	Activates pepsinogen
Pancreatic	Amylase (amylopsin)	**Starch** → **maltose**
	Protease (trypsin)	**Protein** → **amino acids and intermediate products**
	Lipase (steapsin)	**Fats** → **fatty acids and glycerol**
	Maltase	**Maltose** → **glucose**
Intestinal	Protease (erepsin)	**Proteoses** → **amino acids** and **ammonia**
	Disaccharidase sucrase	**Sucrose (cane sugar)** → **glucose and fructose**
	maltase	**Maltose** → **glucose** (2 molecules)
	lactase	**Lactose** → **glucose** and **galactose**
Bile		Aids in digestion of fats by emulsification and saponification

action of the various digestive juices upon the food constituents.

ABSORPTION OF FOOD

No absorption of food takes place from the mouth and almost none from the stomach, although water is to some extent absorbed through the walls of the latter. By far the greater portion of the food material is absorbed from the small intestine. This is as would be expected when it is remembered that the absorbing surface of the small intestine is greatly increased by numerous finger-like projections or processes called villi, which extend into the food mass. Each tiny villus is provided with numerous capillaries, an artery and a vein, and in the center a lymph space called a lacteal or chyle vessel, which

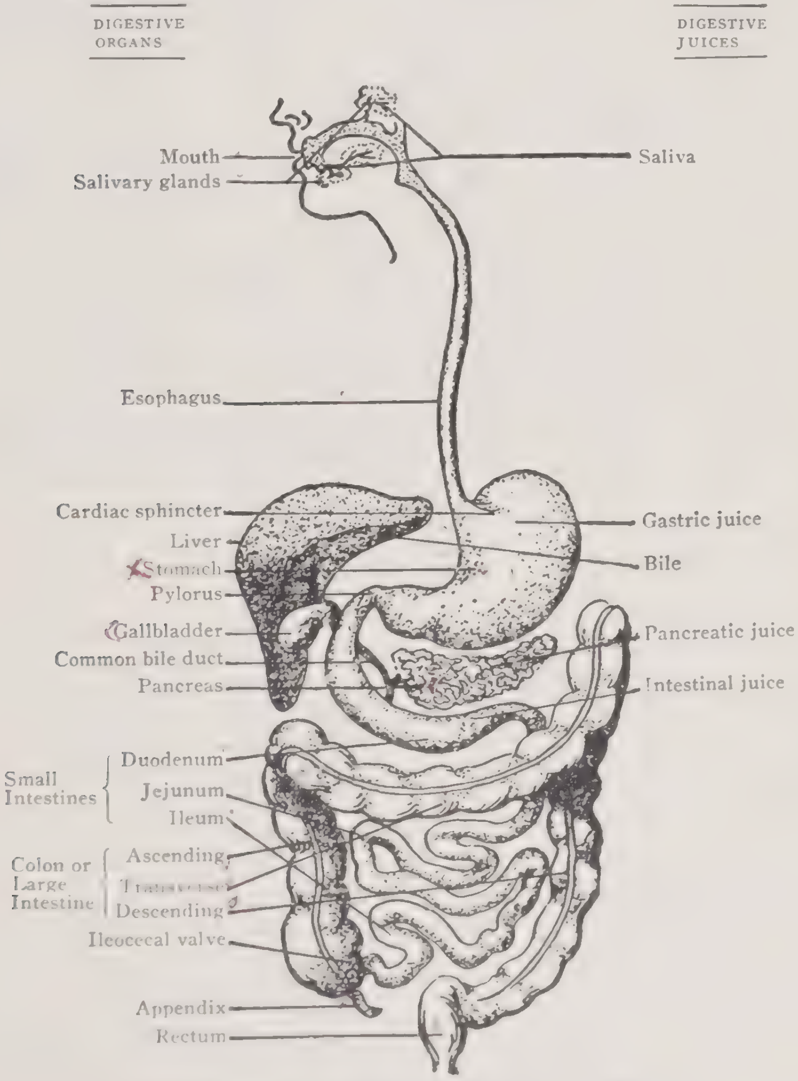

FIG. 29. Diagram of digestive organs and juices, etc.

is a part of the lymphatic system (see Fig. 30). Each villus has a muscular structure that permits of expansion and contraction. Digested food material is absorbed through the walls of the villi into the blood or lymph capillaries and then forced on into the larger blood and lymph vessels of the intestinal wall.

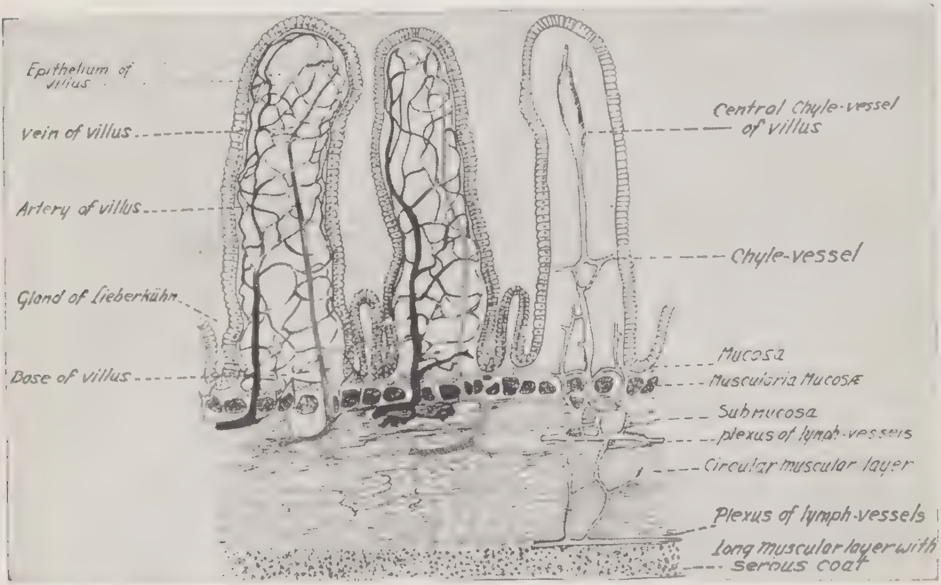

Fig. 30. Diagrammatic drawing (after F. P. Mall) showing the great extension of absorbing surface of the intestinal lining due to the projecting villi.

Selective Absorption. The products of protein digestion, together with those of the starches and the sugars, pass through the walls of the villi into the minute blood vessels, which in turn carry these absorption products into the portal vein and thence to the liver. Products of fat digestion are absorbed through the lacteals of the villi, the fatty acids, glycerol and other substances probably uniting before they pass through the lymphatic system. Unlike carbohydrates and proteins, only a small portion of the digested fat passes directly into the blood stream, the major portion entering the general circulation slowly through the thoracic duct and the subclavian vein in the left shoulder.

The liver and the muscles store part of the sugar as glycogen, and another part may be changed to fat and along with excess fat be stored in the body as adipose tissue. Amino acids, the end products of protein digestion, are allowed to proceed to the tissues where needed. If they are in excess of the needs of the tissues for building or repairs, they are split into two parts. One portion contains nitrogen, most of which is excreted as urea; the other portion, some of which is similar to carbohydrate, is utilized as such. The minerals and the vitamins are absorbed along with and through the same channels as are the proteins, the fats and the carbohydrates. The metabolism of each food constituent has been discussed in more detail in the respective chapters.

Passage of the food along the intestinal tract proceeds with regularity and rhythm. The acid chyme first ejected through the pylorus remains in the duodenum until there have been several similar additions of food material. Segmentation of the food mass is then brought about by contractions of nonconsecutive rings of muscle at different portions of the intestinal tract. These contractions take place first at one point and then at another, thus bringing about a thorough mixing of the food with the digestive juices and aiding in absorption. After a few minutes, contraction and segmentation cease and the small masses of food material are carried forward by peristalsis. The food again masses together, accumulating in the lower portion of the small intestine, the ileum. Remnants of undigested foods are here allowed a longer contact with the digestive juices, digestion being practically completed at this point. What remains of the fluid mass is then passed on into the large intestine, where it is either absorbed or transformed into the typical dark-brown masses known as feces.

The Ileocecal Valve. Between the ileum and the large intestine there is another gate, similar in function to the pylorus of the stomach, known as the ileocecal valve. The food mass passes through the ileocecal valve into the large intestine, where further absorption of fluid may take place. If this valve is unimpaired, it rarely allows any cf the food mass to pass back again into the small intestine. Antiperistalsis, a reverse movement, as well as peristalsis, takes place in the anterior portion of the large intestine, where the food again accumulates. This antiperistaltic movement permits the food material to come into close contact with the walls of the large intestine, thus favoring absorption.

FOOD CHANGES IN THE LARGE INTESTINE

The large intestine does not secrete any enzymes, although digestion continues here, just as salivary digestion continues in the stomach due to digestive juices already mixed with the food. The large intestine fills rather slowly and in it the food mass remains for several hours, sometimes a day or more, during which time water is absorbed from it and the mass takes on more or less form and is finally ejected from the body as feces. The feces consist chiefly of undigested- and indigestible-food materials, with some digestive juices, bacteria and cellular debris of the body tissues.

The control of water balance in the colon is an extremely important one, because both constipation and diarrhea are essentially problems of disturbed water balance. During a day there is secreted into the digestive tract some 8,500 cc. of fluid, most of which is reabsorbed as a carrier of dissolved-food constituents. Complex osmotic-pressure relations determine how much is absorbed and how much left with the intestinal residue. There are numerous environmental and psychic factors that may interfere with the optimum amount of water being retained for normal stool formation and evacuation. According to Gauss [2] it is one function of the bile to control the amount of water in the colon contents. Whatever the controlling mechanism may be, there is much yet to be learned about the functioning of the colon and the process of defecation.

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[2] Gauss, Harry: Am. J. Digest. Dis. **12:** 224. 1945.

FACTORS AFFECTING DIGESTION

Digestibility, as the word is ordinarily used by physicians and nurses as well as the general public, has reference to the ease or the rapidity rather than to the completeness of digestion. Ease of digestion is a much more indefinite term than completeness. Clinically, rapidity of digestion is important; although it has been shown that food that leaves the stomach and is passed on to the intestinal tract undigested, may in the end be as completely digested and absorbed as food that is wholly digested in a shorter time.

The term digestibility as ordinarily used by scientists has reference to the possible completeness of digestion. This is determined by deducting the amount of indigestible and undigested residue from the total of the original food consumed, the difference representing the quantity of food actually digested and absorbed. Some foods—for example, sugar—may be completely digested, but most foods leave some residue. It was found by Atwater, and later by other scientists, that more than 90 per cent of the food of a mixed diet is actually utilized.

Ease of digestion is affected by a number of conditions, among which are the psychologic factors, such as anger and fear, which may very greatly retard digestion. On the other hand, joy and mirth are conducive to more rapid digestion. The kind of food and the method of preparation may also affect this condition. Food to which one is unaccustomed, particularly if it is unattractive, is often digested with difficulty.

The fineness of division of food is another factor that favors ease of digestion. The fineness of division may be brought about by mechanical means during preparation by mashing the food, or by forcing it through a sieve or strainer; or when eating by thorough mastication. In case of illness, foods may be given in forms that are more readily digested, such as gruels, purées or soups. Liquid foods are absorbed more quickly than more solid ones, chiefly because the digestive juices come in contact more quickly with the whole of the substances to be digested. The total quantity of food material taken at one time also has its influence. For this reason it is imperative that persons suffering from acute illness should be fed small amounts at frequent intervals, rather than large amounts at regular meal hours. This is the purpose of "nourishment" as served to hospital patients.

Intestinal motility, the vigor of the peristaltic muscular action, determines the speed with which food masses and residue are moved along the alimentary canal. This motility may be excessive when there is inflammation or infection, and the result is diarrhea. Constipation may result from sluggish motility, which condition may be due to poor muscle tone. Vitamin B complex and a reasonable amount of bulk tend to promote normal motility.

Cellulose and Digestion

Cellulose in all vegetable foods slows digestion, particularly of the proteins. It has been demonstrated that dry legumes (peas, beans and lentils) have coefficients of protein digestibility of 78 per cent, but when free of cellulose their coefficient of digestibility for protein is about as high as for animal foods, 97 per cent. However, a limited amount of cellulose is advantageous, because of its laxative action in the colon. The cellulose in foods, given as fiber in most food tables, is discussed more fully in Chapter 9, and its use in intestinal diseases is considered in Chapter 26.

The table below shows the completeness of digestion of various classes of foods as determined by Atwater: [3]

AVERAGE COEFFICIENTS OF DIGESTIBILITY OF FOODS WHEN USED IN MIXED DIET (CELLULOSE CONTENT NOT INCLUDED)

	Protein per cent	Fat per cent	Carbohydrate per cent
Animal foods.....	97	95	98
Cereals and breadstuffs..........	85	90	98
Dried legumes....	78	90	97
Vegetables.......	83	90	95
Fruits...........	85	90	90
Total food of average mixed diet..	92	95	98

CELL METABOLISM

A study of the digestion and the absorption of foods is not complete without mention of the digestion and the metabolism of food constituents that proceed in the individual cells of the body. Of course this process is not usually considered digestion, but the metabolic processes in the cells resemble digestion in that they depend upon enzyme action. Actually alimentary digestion, complex as it may seem, is simple compared with the complex activities in the tissue cells which provide for synthesis of specific types of protoplasm for each cell, for storage and release of energy, for maintenance of blood constituents and for the elaboration of hormones and enzymes themselves.

Cells cannot grow and multiply and perform their functions unless the necessary constituents are brought to them at all times. The cell is the vital unit of the body and all these myriads of cell units work together as an organized whole. The cells may be compared to one-celled animals, but instead of every cell in the body performing all the functions necessary for life, they have become specialized as to function in the higher animals and every cell in the body is dependent upon many others for existence, i.e., for foods ready for use and for special substances such as hormones and growth substances. The cells may be compared to individuals in human society; each does its own job but depends upon others for existence.

The composition of the cells and the tissues of the body is remarkably constant, yet there is continual change or exchange of constituents. This is known as a state of dynamic equilibrium. Even the cells of such stable structures as teeth and bone are in a state of dynamic equilibrium. Conclusive proof of this has come from the use of tagged elements that could be incorporated in food fed to experimental animals and followed to their ultimate destination in the body tissues. Heavy hydrogen and heavy carbon have molecular weights one more than the usual elements and can be detected by suitable instruments even in living tissue. Physiologically they behave the same as the regular elements as constituents of organic compounds in the body. Radioactive minerals such as iron, calcium and phos phorus have been used as tagged elements in the study of mineral metabolism and have verified the theory that mineral compounds both in hard and in soft tissues are in a constant state of change.

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[3] Atwater, W. O.: Farmers' Bulletin No. 142, U. S. Department of Agriculture, 1902.

Thus for all cell metabolism it is obvious that the necessary materials must be available from the blood and the lymph, and must be replenished continually from the digestive tract and from body stores. The demand will be greater during growth when new cells are forming and a gradual change in certain tissues is taking place. However, even after growth ceases, the adult organism must provide for constant replacement of cell constituents. The body is frugal indeed regarding the waste of essential materials and provides for their reutilization again and again, as in the case of iron for hemoglobin. All these exchanges and resyntheses demand cellular activity and enzyme action. Thus the digestion of food in the alimentary tract is only the first step in the chain of events that must take place before food becomes body tissue.

REVIEW QUESTIONS

1. Digestive enzymes function best at body temperature. This can be demonstrated by digestive mixtures outside the body. How would freezing or boiling temperatures affect enzyme action?

2. Enzyme action is specific as to the substances acted upon and the end products produced. If you wanted to demonstrate a proteolytic enzyme that would attack protein and break it all the way to amino acid, which would you choose?

3. If gastric digestion is slow or incomplete, would it be likely to be due to insufficient pepsin, rennin or hydrochloric acid?

4. The length of time food remains in the stomach varies with the type of food eaten. Why would a diet of bread and vegetables such as thousands in Europe have been eating create the sensation of hunger more than an equal number of calories with some protein and fat present?

5. Certain food faddists caution against eating starches and protein at the same meal. Is there any evidence from the way the digestive enzymes work that would refute this theory?

6. The purpose of digestion is to break down large molecules in food to smaller molecules suitable for use by the blood and the tissues. In a beverage containing milk, sucrose, glucose, salt, iron and vitamins, which factors would need digestion before absorption?

7. Bile is produced in the liver and enters the intestine with the pancreatic juice. If the flow of bile is insufficient, which enzymatic action is most apt to be hindered?

8. The ileocecal valve commands the opening between the small and the large intestine. If the cecum is full, will the resulting pressure on the valve tend to keep it open or closed? Why?

9. More than 8,000 cc. of fluid are secreted into the alimentary canal daily, but often not more than from 1,000 to 2,000 are excreted from the body. If water intake were limited, what would be the first conscious change you would note in these secretions?

10. Fatty acids are absorbed through a different channel than are the sugars and the amino acids. How would this difference affect the rate at which these foodstuffs would reach the blood and the tissues?

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11

Recommended Dietary Allowances

Chapter Topics

THE PROBLEM OF ESTIMATING HUMAN DIETARY NEEDS	DISCUSSION AND INTERPRETATION OF RECOMMENDED ALLOWANCES
TABLE OF RECOMMENDED DIETARY ALLOWANCES WITH FURTHER RECOMMENDATIONS	SAMPLE MENUS—NUTRITIVE VALUE CALCULATED

In the application of the science of nutrition to everyday human needs the first step is for research experts to determine and define the goals of good nutrition—to make a yardstick by which to measure it. The second step is for nutritionists and dietitians to interpret these goals in terms of common foods—to show how to use the yardstick. This chapter is the story of the most successful attempt in the history of nutrition to do this job.

THE PROBLEM OF ESTIMATING HUMAN DIETARY NEEDS

The idea of setting up standards for planning family meals and food supplies is not new. The history of the development of dietary standards parallels in general the changing concepts of nutrition outlined briefly in Chapter 1. In his review article on "The Evolution of Dietary Standards" Leitch[1] compares the figures proposed by various authorities up to 1940. Earlier workers naturally put the emphasis on calories and protein because little or nothing was known about mineral requirements and vitamins had not even been discovered. Some early estimates were based upon what people actually were eating, not upon what they needed.

Even after vitamins were discovered many years had to elapse before methods were developed for quantitative assays, and even then the bulk of the research work was done on animals. Criteria had also to be developed for recognizing early deficiencies and distinguishing between minimum requirements and optimum allowances desirable. The student should appreciate the decades of labor by thousands of research workers that have made possible the present-day tables of dietary recommendations.

Beginning in 1933 some attempts were made to define human requirements for specific nutrients, first by the British Medical Association and later by Stiebeling and coworkers in the United States Department of Agriculture. The standards formulated by the League of Nations

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[1] Leitch, I.: Nutrition Abstr. Rev. **11**:509, 1942.

RECOMMENDED DIETARY ALLOWANCES[1]

REVISED 1945

Food and Nutrition Board, National Research Council

	Calories	Protein Gm.	Calcium Gm.	Iron mg.	Vitamin A I.U.[2]	Thiamine mg.[3]	Riboflavin mg.[3]	Niacin (Nicotinic Acid) mg.[3]	Ascorbic Acid mg.	Vitamin D I.U.
Man (154 lbs., 70 kg.)										
Sedentary	2,500	70	0.8	12[4]	5,000	1.2	1.6	12	75	[5]
Moderately active	3,000	70	0.8	12[4]	5,000	1.5	2.0	15	75	[5]
Very active	4,500	70	0.8	12[4]	5,000	2.0	2.6	20	75	[5]
Woman (123 lbs., 56 kg.)										
Sedentary	2,100	60	0.8	12	5,000	1.1	1.5	11	70	[5]
Moderately active	2,500	60	0.8	12	5,000	1.2	1.6	12	70	[5]
Very active	3,000	60	0.8	12	5,000	1.5	2.0	15	70	[5]
Pregnancy (latter half)	2,500[6]	85	1.5	15	6,000	1.8	2.5	18	100	400 to 800
Lactation	3,000	100	2.0	15	8,000	2.0	3.0	20	150	400 to 800
Children up to 12 yrs.:[7]										
Under 1 yr.[8]	100/2.2 lbs. (1 kg.)	3.5/2.2 lbs. (1 kg.)	1.0	6	1,500	0.4	0.6	4	30	400 to 800
1-3 yrs. (29 lbs., 13 kg.)	1,200	40	1.0	7	2,000	0.6	0.9	6	35	400
4-6 yrs. (42 lbs., 19 kg.)	1,600	50	1.0	8	2,500	0.8	1.2	8	50	400
7-9 yrs. (55 lbs., 25 kg.)	2,000	60	1.0	10	3,500	1.0	1.5	10	60	400
10-12 yrs. (75 lbs., 34 kg.)	2,500	70	1.2	12	4,500	1.2	1.8	12	75	400
Children over 12 yrs.:[7]										
Girls, 13-15 yrs. (108 lbs., 49 kg.)	2,600	80	1.3	15	5,000	1.3	2.0	13	80	400
16-20 yrs. (119 lbs., 54 kg.)	2,400	75	1.0	15	5,000	1.2	1.8	12	80	400
Boys, 13-15 yrs. (103 lbs., 47 kg.)	3,200	85	1.4	15	5,000	1.5	2.0	15	90	400
16-20 yrs. (141 lbs., 64 kg.)	3,800	100	1.4	15	6,000	1.8	2.5	18	100	400

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[1] Tentative goal toward which to aim in planning practical dietaries; can be met by a good diet with a variety of natural foods. Such a diet will also provide other minerals and vitamins, the requirements for which are less well known.

[2] The allowance depends on the relative amounts of vitamin A and carotene. The allowances of the table are based on the premise that approximately two thirds of the vitamin A value of the average diet in this country is contributed by carotene and that carotene has half or less than half the value of vitamin A.

For adults (except pregnant and lactating women) receiving diets supplying 2,000 calories or less, such as reducing diets, the allowances of thiamine, riboflavin and niacin may be 1.0 mg., 1.5 mg. and 10 mg., respectively. The fact that figures are given for different caloric levels for thiamine, riboflavin and niacin does not imply that we can estimate the requirement of these factors within 500 calories, but they are added merely for simplicity of calculation. Other members of the B complex also are required, though no values can be given. Foods supplying adequate thiamine, riboflavin and niacin will tend to supply sufficient of the remaining B vitamins.

There is evidence that the male adult needs little or no iron. The allowance will be provided if the diet is satisfactory in other respects.

§ For persons who have no opportunity for exposure to clear sunshine and for elderly persons, the ingestion of small amounts of vitamin D may be desirable. Other adults probably have little need of vitamin D.

During the latter part of pregnancy the allowance should increase approximately 20 per cent over the preceding level. The value of 2,500 calories represents the allowance for pregnant, sedentary women.

Allowances for children are based on the needs for the middle year in each group (such as 2, 5, 8, etc.) and are for moderate activity and for average weight at the middle year of the age group.

Needs of infants increase from month to month with size and activity. The amounts given are for approximately from 6 to 8 months. The dietary requirements for some of the nutrients such as protein and calcium are less if derived largely from human milk.

Further recommendations

Fat. There is available little information concerning the human requirement for fat. Fat allowances must be based at present more on food habits than on physiologic requirements. While a requirement for certain unsaturated fatty acids (the linoleic and arachidonic acids of natural fats) has been amply demonstrated with experimental animals, the human need for these fatty acids is not known. In spite of the paucity of information on this subject there are several factors which make it desirable that fat be included in the diet to the extent of from 20 to 25 per cent at least of the total calories and that the fat intake include "essential" unsaturated fatty acids to the extent of at least 1 per cent of the total calories. At higher levels of caloric expenditure, e.g., for a very active person consuming 4,500 calories and for children and adolescent persons, it is desirable that from 30 to 35 per cent of the total calories be derived from fat. Since foodstuffs such as meat, milk, cheese and nuts may be expected to contribute "invisible" fat to the extent of from one half to two thirds of the total amounts of fat implied by the above proportions of the total calories, it is satisfactory to use separated or "visible" fats such as butter, margarine, lard and shortenings only to the extent of from one third to one half of the amounts indicated.

Copper. The requirement for copper for adults is from about 1 to 2 mg. daily. Infants and children require approximately 0.05 mg. for each kilogram of body weight. The requirement for copper is approximately one tenth that for iron. A good diet normally will supply sufficient copper.

Iodine. The requirement for iodine is small, probably from about 0.002 to 0.004 mg. daily for each kilogram of body weight, or a total of from 0.15 to 0.30 mg. daily for the adult. This need is met by the regular use of iodized salt; its use is especially important in *adolescence* and *pregnancy*.

Phosphorus. Available evidence indicates that the phosphorus allowances should be at least equal to those for calcium in the diets of children and of women during the latter part of pregnancy and during lactation. In the case of other adults the phosphorus allowances should be approximately 1.5 times those for calcium. In general it is safe to assume that if the calcium and protein needs are met through common foods, the phosphorus requirement also will be covered, because the common foods richest in calcium and protein are also the best sources of phosphorus.

Vitamin K. The requirement for vitamin K usually is satisfied by any good diet. Special consideration needs to be given to newborn infants. Physicians commonly give vitamin K either to the mother before delivery or to the infant immediately after birth.

Salt. The needs for salt and for water are closely interrelated. A liberal allowance of sodium chloride for the adult is 5 grams daily, except for some persons who sweat profusely. The average normal intake of salt is from 10 to 15 grams daily, an amount which meets the salt requirements for a water intake up to 4 liters daily. When sweating is excessive, one additional gram of salt should be consumed for each liter of water in excess of 4 liters daily. With heavy work or in hot climates from 20 to 30 grams daily may be consumed with meals and in drinking water. Even then, most persons do not need more salt than usually occurs in prepared foods. It has been shown that after acclimatization persons produce sweat that contains only about 0.5 gram to the liter in contrast with a content of from 2 to 3 grams for sweat of the unacclimatized person. Consequently, after acclimatization the need for increase of salt beyond that of ordinary food disappears.

Water. A suitable allowance of water for adults is 2.5 liters daily in most instances. An ordinary standard for diverse persons is one milliliter for each calorie of food. Most of this quantity is contained in prepared foods. At work or in hot weather, requirements may reach from 5 to 13 liters daily. Water should be allowed *ad libitum*, since sensations of thirst usually serve as adequate guides to intake except for infants and sick persons.

Health Committee in 1935 were the first to represent group opinion and were based on the limited information then available.

When the Food and Nutrition Board was appointed by the National Research Council in 1940, it undertook as one of its most important projects the formulation of a set of figures for human requirements in terms of specific nutrients. The National Nutrition Program could not be undertaken without some such recognized goal for planning adequate diets. For this purpose it seemed desirable to state allowances that would be suitable for the maintenance of good nutrition rather than minimum requirements, as had been done previously. It was impossible then, as it still is, to establish values for all age and sex categories on the basis of acceptable research work on each group. There are still many gaps in scientific knowledge of human requirements for each known nutrient and the probability that some factors yet remain to be discovered.

TABLE OF RECOMMENDED DIETARY ALLOWANCES WITH FURTHER RECOMMENDATIONS

The table of Recommended Dietary Allowances as originally published in May, 1941, and popularly called the Yardstick of Good Nutrition, represented the combined and the seasoned judgment of nutrition authorities. The history of the way this table was formulated is worthy of note. The published evidence regarding human requirements for each nutrient to be considered was reviewed critically by a large number of other nutrition authorities actively engaged in research. The choice of nutrients listed was based upon the likelihood of deficiencies and available data. Tentative allowances were formulated from the evidence assembled and again submitted to every contributor for criticism. Thus the values represented the consensus of judgment of the entire group, although some contributors might not have agreed with every figure. The same general policy has been followed in making subsequent revisions.

In 1942 some minor revisions were made in the footnotes to take care of iodine, copper and vitamin K, about which questions had arisen. Since 1943 considerable evidence has been accumulating to the effect that some of the recommendations for the B group of vitamins were unnecessarily generous and that a revision downward might be in order. After serious consideration at several meetings of the Board over a period of a year, the revised table of Recommended Dietary Allowances was adopted by the Board in June, 1945, and published in August 1945.[2]

In using the recommendations, it is important that the purposes and the general policies of the Board should be understood. These purposes are explained more in detail in the original publication, with which every student of the subject should be familiar. The Board adopted the term recommended allowances rather than standards to avoid any implication of finality.

The table or allowances with footnotes and the paragraphs headed Further Recommendations are quoted in full in this chapter. The student is referred to the original publication for further details.

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[2] Recommended Dietary Allowances, National Research Council, Reprint and Circular Series No. 122, Washington, Aug., 1945

DISCUSSION AND INTERPRETATION OF RECOMMENDED ALLOWANCES

For proper and intelligent use of the recommended allowances the following explanation quoted from the original publication is essential:

> The allowances for adults are given for a man of 70 Kg. and a woman of 56 Kg. They should be decreased or increased proportionately for smaller or larger persons and for different levels of activity. The allowances for children are given for age groups, and for boys and girls separately after 12 years because from that age the growth curves and the levels of activity differ. The values stated are for the middle age of the group and for children of average size and activity.
>
> The allowances during the growth period as shown in the table may appear to have steplike changes from one age category to another because of their being tabulated by age groups. Obviously such abrupt changes in requirement cannot occur. A man lacking one day of being 21 years of age does not have a protein requirement which decreases overnight from 100 to 70 Gm. Actually the allowances are stated for the middle of the age group and they are different on each side of the middle. When the allowances that are given are plotted by age, a curve is obtained that permits interpolation for ages for which no values are given. The curve of values slopes gradually from those stated for 18 years to those for adults, beginning at 21 years. For most of the nutrients listed the values at 20 years are little different from those at 21. Since size is as important as age, if not more important, at different periods of development, probably a band rather than a line on a graph represents the truth more adequately.
>
> The allowances are for persons in health. Needs vary greatly in disease. For example, in febrile conditions an increased need usually exists for calories, thiamin and ascorbic acid. The need for these and other constituents may be greatly altered also in other diseases, especially those of the alimentary tract which interfere with absorption.
>
> The values of the table are for content of foods as eaten and do not allow for losses in storage, cooking and serving. Because such losses, especially of the water-soluble vitamins, may be extensive, provision should be made for them in planning practical dietaries.
>
> The allowances are intended to serve as a guide for planning an adequate diet for every normal person of the population and not for the average member of the group categories. Experience has shown that the biologic normal consists of a range of values. An allowance based on the need of the average of a group would be greater than the need of many and less than the need of many others. Many normal adult males require only 2,200 calories or less and many can subsist in health with half the stated protein allowance. Some children need no supplemental vitamin D, while others require the amount stated. In order to meet the needs of the whole population it is necessary to satisfy the requirements of those with less efficient usage. Because the allowances take into consideration the requirements of those at the upper level of the normal range of requirement, they allow a factor of safety for persons who have an average or less than average requirement. In most categories this factor of safety is approximately 30 per cent, but for many normal persons the allowances cover only the amounts needed for maintenance. Insomuch as many persons who receive less than the recommended allowance of one or another nutrient may remain in excellent health through long periods, it becomes apparent that these allowances are not to be used as the sole criterion for judging the state of nutrition of any population.

In spite of careful explanation as to the meaning of this yardstick and how it should be used, there has been a tendency, ever since the publication of the first edition, for some enthusiastic promoters of nutrition to misuse the figures. Results of dietary surveys have been carelessly interpreted in making comparisons with the recommended allowances. The inference has sometimes been drawn that diets which failed to meet these levels were subminimum and that persons living on such diets were malnourished and likely to show signs of deficiencies. Such conclusions ignore the broad margin between optimum allowances and minimum requirements.

The problems that arose with the feeding of civil populations in liberated countries emphasized that the liberal margins of safety highly desirable in normal times might become untenable when whole nations were starving. It then becomes desirable to raise the diet of as many people as possible to the minimum-requirement levels. When Americans were required, during the war, to curtail consumption of meat, cheese and fats, at no time were the restrictions such as to cut the average consumer much, if any, below recommended allowances. Even if it did so for certain groups, the restrictions were well within the margin of safety provided by the allowances.

In using the nutrition yardstick it is to be emphasized that the amounts of the various nutrients, with the exception of vitamin D, can be obtained through a good diet of natural foods. Flour or bread should be whole-grain or enriched. It is fortunate that optimum nutrition can be provided by an unlimited number of combinations of different foods. Excessive use of vitamin-poor foods should be avoided, of course, and loss and waste in preparation and in serving should be kept to a minimum. The translation of the allowances into sample menus to fit different localities and incomes is discussed later in this chapter.

The basic dietary pattern outlined in Chapter 2 and used in the discussion of the individual nutrients provides for an ample supply of the eight nutrients other than vitamin D with a total caloric value of only 1,500. Other foods chosen to suit appetite, growth and activity needs might add substantially to these figures.

SAMPLE MENUS—NUTRITIVE VALUE CALCULATED

Various dietary patterns might be suggested that would measure up equally well to the yardstick of good nutrition. It is important to recognize personal, family and racial preferences when planning meals, especially for the sick. This has an important bearing also on the ultimate success of the nutrition program. It is not the time when a person has a poor appetite to introduce unfamiliar or disliked foods. To attempt to do so often prejudices people against wanting to apply nutrition information. Too often the idea of "eating what is good for you" has meant eating food that was disagreeable or distasteful. Thus the nurse or the nutritionist must take pains to interpret needs in terms of favorite foods available in the particular locality, in season and suitable to the income level of the group concerned.

The first suggested menu for an adult man is of moderate cost and suited to a large part of the United States, particularly northern and central areas. The menus for the three meals are suggested and the nutritive value calculated in tabular form on page 132. It will be noted that the food value of this menu exceeds the recommended allowances with a liberal margin in all factors:

MENU No. 1

Breakfast

Orange
Oatmeal
Whole milk
Egg
Toast and butter
Coffee with cream and sugar

Lunch

Baked beans
Cabbage slaw
Boston brown bread and butter
Stewed prunes
Peanut cookies
Milk

Dinner

Pot roast of beef
Potatoes, boiled
Carrots, strips, raw
Peas, canned or frozen
Bread and butter
Rice pudding with raisins
Coffee with cream and sugar

The second menu for an adult man is low-cost and typical of certain groups especially in southern United States.

MENU No. 2

Breakfast

Grits and pork gravy
or
Corn-meal pancakes, fat pork and molasses
Coffee with evaporated milk

Lunch

Hot biscuits
Peanut butter
Molasses
Turnip greens, cooked with fat pork

Dinner

Pork shoulder
Sweet potatoes
Tomatoes
Black-eyed peas
Buttermilk
Corn bread and margarine

The second list of foods contains less milk, no fruit, no egg and less variety, but it measures up to recommended allowances almost as well as the first. It must be remembered that the calcium from greens may not be as readily available as that from milk, but the liberal supply allows for some not being used. Also, the larger proportion of carotene from vegetables may not be as efficient as vitamin A from animal sources but there are several times the recommended allowance of this factor. (See calculation on page 133.)

Numerous other combinations could be equally adequate and adapted to available food supplies and dietary customs. It is recommended that the student calculate a day's menu typical of her own family and locality. In so doing it will be noted that each food in such a list plays a specific role and, if omitted, has to be replaced by another of similar food value to keep the day's menu adequate. This problem of equivalents in food values bothered many a homemaker during the war when supplies were scarce. A knowledge of food equivalents makes it easier to plan for variety in meals while keeping the food value adequate.

REVIEW QUESTIONS

1. Quantitative estimates of human dietary needs have been offered at various times, but with some divergence of opinion. Why is it difficult to calculate dietary requirements?

2. The Food and Nutrition Board of the National Research Council has recommended dietary allowances for certain specific nutrients. Which ones are listed in this table? Which others

MENU NO. 1

Moderate-cost Menu for Moderately Active Man

Foods	Amt. Gm.	Approximate Measure	Calories	Protein Gm.	Calcium Gm.	Iron mg.	Vitamin A I.U.	Thiamine mcg.	Riboflavin mcg.	Niacin mg.	Ascorbic Acid mg.
Milk	480	2 cups	346	17	.58	.5	768	192	816	.5	5
Egg	50	1	82	6	.03	1.4	570	60	170	....	...
Beef, pot roast medium fat	100	Med. serv.	270	27	.01	2.9	......	72	150	5.0	...
Potato, boiled	200	2 large	152	4	.02	1.4	80	180	68	1.8	22
Peas, canned	100	½ cup	48	3	.03	1.8	540	110	60	.9	8
Beans, baked N.E. style	200	1 cup	220	12	.10	3.4	30	21	54	.2	...
Carrots, raw	50	1 small	18	...	.02	.4	6,000	35	30	.3	3
Cabbage, raw	50	¾ cup	10	...	.03	.3	20	35	22	.2	26
Orange	100	1 med.	40	1	.03	.4	190	80	30	.2	50
Prunes, stewed	100	½ cup	168	1	.02	.8	300	50	80	.4	2
Butter (or margarine)	50	5 pats	367	...	....	.1	1,500	.....	4	....	0
Oatmeal, cooked	200	1 cup	122	4	.02	1.8	......	200	40	.6	0
Peanut cookies	50	3 small	260	7	.01	.3	30	90	65	2.0	0
Bread, white enriched	200	6 slices	524	18	.12	3.6	......	480	310	4.4	0
Bread, Boston brown	100	2 slices	207	5	.05	3.0	146	150	106	0	0
Rice pudding with raisins	110	½ cup	142	3	.08	.8	83	40	118	.4	0
Cream	25	3 tbsp.	52	1	.03	....	208	7	35	....	...
Sugar	12	3 tsp.	50	...	....	....	......	.....	.....	....	...
Totals	...	....	3,078	109	1.18	22.9	10,465	1,802	2,158	16.9	116
Compared with recommended allowances	...	....	3,000	70	.8	12	5,000	1,500	2,000	15	75

MENU NO. 2

Low-cost Menu for Moderately Active Man (Southern)

Foods	Amt. Gm.	Approximate Measure	Calories	Protein Gm.	Calcium Gm.	Iron mg.	Vitamin A I.U.	Thiamine mcg.	Riboflavin mcg.	Niacin mg.	Ascorbic Acid mg.
Turnip greens, cooked	100	½ cup	28	3	.26	2.4	10,000	100	450	.8	44
Sweet potatoes, cooked	200	2 med.	242	4	.06	1.4	14,000	180	120	1.4	20
Cowpeas, dry	50	⅓ cup	175	12	.04	3.9	..	430	120	1.1	1
Tomatoes, canned	100	½ cup	16	1	.01	.6	1,050	50	30	.7	16
Corn meal or grits, white	100	⅔ cup	360	9	.02	2.7	0	410	120	1.1	0
Flour, enriched, self rising (biscuits)	100	¾ cup	357	11	.22	2.9	0	440	264	3.5	0
Milk, fresh, dry or evaporated or buttermilk	240	1 cup	173	8	.29	.3	380	96	408	.3	3
Pork shoulder, medium fat	100	1 serv.	428	13	.01	2.5	......	691	190	3.0	0
Fat pork	100	2 serv.	781	4	....	.6	......	180	40	.9	0
Margarine, fortified	20	2 pats	145		.	..	400	....	....	...	.
Molasses	50	3 tbsp.	120		.14	3.3	......	40	80	.1	0
Peanut butter or peanuts	30	2 tbsp.	184	8	.2	.6	....	60	50	5.1	0
Total		...	3,009	73	1.25	21.2	25,830	2,677	1,872	18.0	84
Compared with recommended allowances	.	...	3,000	70	.8	12	5,000	1,500	2,000	15	75

are considered under Further Recommendations? And why?

3. These allowances are listed for different age and sex categories. For which of these are the allowances greater than for the average man? Why?

4. The degree of activity influences the allowance for certain nutrients more than for others. For which factors do the allowances vary directly with the caloric requirement, and does this relationship hold at all levels?

5. The recommended allowances for children are estimated for age groups. How is the average value for each age group computed and what values would you use for a 12-year-old boy large for his age?

6. When the recommended allowances are used for comparison with actual food nutrients consumed by a group of persons being studied, what kind of statement can be made regarding the proportion of those who fail to meet this standard?

7. The recommended allowances may be met by a variety of natural foods. Make substitutions in the sample menus given without lowering any nutrient below the recommended level.

8. The food patterns often suggested in posters and in pamphlets do not fit nationality or regional food patterns. Choose any dietary pattern with which you are familiar and plan a day's menu to meet the recommended allowances, using foods well liked by the people for whom it is intended.

12

Meal Planning for the Family

Chapter Topics

- MEAL PLANNING TO FIT FAMILY NEEDS
- TABLE OF FAMILY FOOD ALLOWANCES
- THREE GOOD DIETS
- MENU AND MARKET ORDER FOR A FAMILY OF FOUR
- ECONOMY HINTS

MEAL PLANNING TO FIT FAMILY NEEDS

The planning of the family menu is more complicated than that of the individual adult menu, since the nutritive requirements for children and elderly people are somewhat different from those of adults in the prime of life. It would be folly to give a small child everything that appears on the family menu. This, however, should be planned in such a way that few special foods need be prepared for him. The question of food for children is discussed in detail in Chapters 16 and 17, and of course any member of the family who is ill must have special consideration. All diets, however, should be planned round the family menu, as the essentials are the same for all. Therapeutic diets are discussed in Part Two.

The elderly person, too often a forgotten member of the household, may require some special foods or food preparation, but so far as possible he or she should be a member of the family at mealtime and eat foods prepared for the family. If digestive ability is limited, the family meals should be so planned that the older person will avoid fried foods, rich sauces, pastries and other foods that disagree with him. When mealtime appetite makes an adequate food intake difficult, a midmorning and a midafternoon lunch of something light, such as hot malted milk or orange juice, may be planned. Other special attention, such as a hot drink at bedtime, may be welcomed and may help to induce sleep.

From the foods necessary for good nutrition, meals that appeal to the appetite may be planned. These should be varied, although not at the expense of food essentials. When the food budget is liberal, it is naturally much easier to plan interesting meals.

Food allowances at three cost levels are given in the two-page table later in this chapter. These will be particularly useful when costs must be figured closely. When more money is available, the allowances for meat, fruits, fresh vegetables and butter may be increased. In this case the allowances for potatoes, dried vegetables and nuts, flour, bread and cereals, may automatically decrease. In any case, it will be well to use whole-grain or restored cereals and whole-grain or enriched bread or flour in all diets. A market order for any family may be charted from the allowances shown and from them menus may be made.

BREAKFAST

The breakfast menu should be simple, but abundant. A substantial breakfast is a good starter for a busy or a hard day. Only persons of sedentary habits who rise late and lunch early can profitably omit the morning meal; those who lead a strenuous life should fortify themselves by a well-selected breakfast.

The breakfast should consist of at least a fruit and a cereal, toast and a beverage. Oranges, grapefruit, the juice of one of them, or tomato juice is often the choice for breakfast, because these fruits are such potent sources of vitamin C. Other fruit juices, sliced bananas, cooked, fresh or dried fruit, or canned fruit are also used at breakfast.

A hot cereal such as oatmeal or a whole-wheat product is usually served when there are children in a family. The ready-to-eat cereals are convenient when time is important, although they are more expensive than home-cooked cereals. Many cereals of both types now have one or more vitamins and minerals added to help restore them in part to whole-grain nutritive value. Whole milk should always be served with the cereals. This may be supplemented by cream. Cereal at breakfast gives an opportunity to use a portion of the milk that should be consumed each day.

Eggs and Bacon. This favorite American breakfast has much to be said for it nutritionally. Breakfast is a good time to get the egg a day recommended by many nutritionists, and bacon, high in fat, has the staying quality that prevents those forenoon hunger pangs. Recent work indicates that foods such as bacon and eggs, which are largely protein and fat, are less likely than carbohydrate to stimulate a rapid rise and a subsequent drop in blood sugar, which are responsible for the exhaustion experienced by people who eat a light breakfast with a large proportion of starch and sugar.

Toast or rolls, which are usually served at breakfast, may supplement the cereal or, if taken in sufficient quantities, may replace it. In this case care should be taken to utilize the milk at another meal unless it is used as such or in cocoa with breakfast.

A hot beverage is a desirable part of breakfast for most adults. Coffee is the general choice in this country, although tea, cereal coffee or cocoa may replace it. Cocoa made with milk may be provided for the children if they will not take milk itself, but they should never be allowed tea or coffee.

DINNER

Dinner, which may be served at noon or at night, is the main meal of the day. Certain types of menus are used customarily at this meal. If luncheon is eaten away from home by any members of the family, a special effort should be made to supply at dinner protective foods that may have been lacking at luncheon. The main course for dinner generally consists of meat, potatoes or a cereal product such as rice, spaghetti or macaroni, at least one green vegetable, bread in some form, a dessert and a beverage. A salad should be added if it has not been part of the luncheon menu. A hot soup or an appetizer of some sort may introduce the meal. A clear soup or a consommé is usually chosen as a dinner soup.

Meat, Poultry or Fish. Roasts, steaks, chops or stews of lamb, mutton, pork, beef or veal, as well as poultry, game or fish, prepared in different ways provide a wide variety of main dishes for the dinner menu. Variety meats and alternate dishes made with eggs, cheese, beans or nuts may be used as the main dish when meats are scarce.

Vegetables. Potatoes are commonly served at dinner. They are valuable contributors to the supply of minerals which we need daily and can also be counted upon for some of the vitamins. The warning that McCollum gives against "the bread, meat and potato type" of diet is not directed against the potato itself when supplemented by green vegetables.

Salads. A green salad is usually chosen for dinner service. Of the salad vegetables, lettuce is most generally available. It is used extensively, but is not so rich in minerals or vitamins as most other leafy vegetables. Romaine, escarole, endive, chicory, watercress, cabbage and raw spinach may be used by themselves or in mixed form. The dressing used with salad at dinner is usually a mixture of salad oil, lemon juice or vinegar and seasonings, and is known as French dressing.

Dessert may be simple or elaborate, but it should be adjusted to the rest of the meal. If the meal is comparatively rich or heavy, the dessert should be simple. Desserts that are excessively rich in sweets or fats should be avoided, especially in the diets of children and invalids. Most acute digestive disturbances are due to too much fat or too much sweet. There is no doubt that Americans, who consume more than 100 pounds of sugar per capita per year in normal times, are using this carbohydrate greatly in excess of the optimum physiologic requirements. The function and the metabolism of sugars are discussed in Chapter 3.

Unless milk has been used abundantly in the preparation of other dishes, it is a wise plan to take the opportunity to introduce a portion of the daily quota of that important food into the dessert. Fresh fruits are excellent desserts, especially for children and elderly people, since they are easily digested and are rich in the vitamins.

Beverages are discussed in detail in another chapter, and in passing it is sufficient to say here that practically the only virtue possessed by our common beverages—tea and coffee—is that they are relished for their flavor and they introduce relatively large quantities of water into the diet. The heat of hot beverages seems also to stimulate an otherwise sluggish digestion; but because of their stimulating properties, it is wise to consult the doctor before serving them.

LUNCHEON OR SUPPER

The third meal of the day may be either a luncheon or a supper. It may serve as a means of making up any dietary deficiency that may have existed in the other two meals. If the full quota of milk has not been consumed, it would seem advisable to serve a cream soup or chowder, cocoa for beverage or a dessert with a custard foundation; or if the leafy vegetable has not been represented in the dinner meal, a salad would be indicated. A more substantial salad may serve as the main course for luncheon, especially in warm weather.

Several authorities now recommend light midmorning and midafternoon lunches of fruit or other simple foods as a means of increasing efficiency.

FAMILY FOOD ALLOWANCES *

Three Good Diets at Three Levels of Cost Prepared by the U. S. Bureau of Home Economics. Kinds and Amounts of Foods for a Week.

Persons	Milk[1]	Potatoes, sweet-potatoes		Tomatoes, citrus fruit		Leafy, green, yellow vegetables		Dried beans, peas, or nuts	
	Quarts	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*
This is an									
Children under 2 years	5	1	0	1	8	1	8	0	0
Children 2–3 years	7	1	8	1	8	2	8	0	0
Boys:									
4 to 6 years	7	1	12	1	8	2	8	0	0
7 to 8 years	7	2	0	1	12	3	8	0	1
9 to 10 years	7	2	0	2	0	3	12	0	1
11 to 12 years	7	2	4	2	4	3	12	0	1
13 to 15 years	7	3	0	2	8	3	8	0	2
16 to 19 years	7	4	4	2	8	3	8	0	2
Girls:									
4 to 7 years	7	1	12	1	8	2	8	0	0
8 to 10 years	7	2	0	1	12	3	8	0	1
11 to 13 years	7	2	0	2	0	3	12	0	1
14 to 19 years	7	2	4	2	4	3	12	0	1
Men 20 years and over:									
Active work	3½	5	12	2	8	3	8	0	2
Moderate work	3½	3	0	2	8	3	8	0	2
Inactive	5	2	4	2	4	3	12	0	1
Women 20 years and over:									
Active work	3½	3	0	2	8	4	0	0	1
Moderate work	3½	2	4	2	4	4	0	0	1
Inactive	5	1	8	2	4	3	12	0	1
This is a									
Children under 2 years	5	1	0	1	8	1	8	0	0
Children 2–3 years	7	1	12	1	8	2	8	0	0
Boys:									
4 to 6 years	7	2	0	1	8	2	8	0	1
7 to 8 years	7	2	0	1	8	3	8	0	2
9 to 10 years	7	2	4	1	12	3	12	0	2
11 to 12 years	7	2	8	1	12	3	12	0	2
13 to 15 years	7	3	0	2	0	3	0	0	4
16 to 19 years	7	4	4	2	0	3	0	0	4
Girls:									
4 to 7 years	7	2	0	1	8	2	8	0	1
8 to 10 years	7	2	0	1	8	3	8	0	2
11 to 13 years	7	2	4	1	12	3	12	0	2
14 to 19 years	7	2	8	1	12	3	12	0	2
Men 20 years and over:									
Active work	3½	5	12	2	0	3	0	0	4
Moderate work	3½	3	0	2	0	3	0	0	3
Inactive	5	2	8	1	12	3	8	0	2
Women 20 years and over:									
Active work	3½	3	0	2	0	4	0	0	4
Moderate work	3½	2	8	1	12	4	0	0	2
Inactive	5	1	12	1	12	3	8	0	2
This is a									
Children under 2 years	5	1	8	1	4	1	8	0	0
Children 2–3 years	7	1	12	1	4	2	8	0	0
Boys:									
4 to 6 years	7	2	0	1	4	2	8	0	2
7 to 8 years	5–7	2	4	1	4	3	8	0	3
9 to 10 years	5–7	2	8	1	4	3	12	0	3
11 to 12 years	5–7	2	12	1	4	3	12	0	4
13 to 15 years	5–7	3	0	1	4	3	0	0	4
16 to 19 years	5–7	4	4	1	4	3	0	0	4
Girls:									
4 to 7 years	7	2	0	1	4	2	8	0	2
8 to 10 years	5–7	2	4	1	4	3	8	0	3
11 to 13 years	5–7	2	8	1	4	3	12	0	3
14 to 19 years	5–7	2	12	1	4	3	12	0	4
Men 20 years and over:									
Active work	3½	5	12	1	4	3	0	0	8
Moderate work	3½	3	0	1	4	3	0	0	6
Inactive	3½-5	2	12	1	4	3	8	0	3
Women 20 years and over:									
Active work	3½	3	0	1	4	3	8	0	4
Moderate work	3½	2	12	1	4	3	8	0	4
Inactive	3½-5	2	0	1	4	3	8	0	3

[1] Or its equivalent in cheese, evaporated or dried milk.

[2] Count fatty bacon and fat back as fat, not as meat.

* Consumer's Guide, 7: 10-11, Nov., 1940.

FAMILY FOOD ALLOWANCES *

Three Good Diets at Three Levels of Cost Prepared by the U. S. Bureau of Home Economics. Kinds and Amounts of Foods for a Week.

Dried fruit		Other vegetables, fruits		Eggs	Lean meat, poultry, fish [3]		Flour, bread,[3] cereals		Sugars [4]		Butter		Other fats	
Lbs.	*Oz.*	*Lbs.*	*Oz.*	*Number*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*
expensive good diet														
0	0	0	0	4	0	0	0	12	0	1	0	2	0	0
0	1	2	8	6	0	6	1	0	0	2	0	3	0	0
0	1	4	0	7	0	12	1	4	0	4	0	4	0	1
0	2	5	0	7	1	12	1	8	0	8	0	8	0	1
0	2	5	12	7	2	8	1	8	0	12	0	12	0	1
0	3	6	0	7	3	0	1	8	0	12	0	12	0	1
0	3	7	0	7	3	12	2	0	1	0	0	12	0	3
0	3	8	0	7	4	12	2	8	1	8	0	12	0	12
0	1	4	0	7	0	12	1	4	0	4	0	4	0	1
0	2	5	0	7	1	12	1	8	0	8	0	8	0	1
0	2	5	12	7	2	8	1	8	0	12	0	12	0	1
0	3	6	0	7	3	0	1	8	0	12	0	12	0	1
0	2	8	0	7	4	12	4	8	2	0	0	12	1	2
0	2	7	0	7	4	0	2	4	1	4	0	12	0	8
0	2	5	8	7	2	8	1	12	0	12	0	12	0	1
0	2	7	0	7	3	12	2	4	1	4	0	12	0	8
0	2	6	0	7	3	0	1	12	1	0	0	12	0	3
0	2	5	8	7	2	8	1	4	0	12	0	12	0	1
moderate-cost good diet														
0	0	0	0	4	0	0	0	12	0	1	0	2	0	0
0	1	1	12	6	0	6	1	4	0	2	0	3	0	0
0	2	2	0	7	0	12	1	8	0	4	0	4	0	1
0	3	2	8	7	1	8	2	0	0	8	0	8	0	1
0	4	3	4	7	2	0	2	8	0	12	0	8	0	4
0	4	4	0	6	2	8	2	8	0	12	0	8	0	4
0	5	5	8	6	2	12	3	4	1	0	0	8	0	8
0	6	6	0	5	3	0	3	12	1	8	0	8	1	1
0	2	2	0	7	0	12	1	8	0	4	0	4	0	1
0	3	2	8	7	1	8	2	0	0	8	0	8	0	1
0	4	3	4	7	2	0	2	8	0	12	0	8	0	4
0	4	4	0	6	2	8	2	8	0	12	0	8	0	4
0	6	5	8	5	3	12	5	12	2	0	0	8	1	7
0	4	5	0	5	3	0	3	8	1	4	0	8	0	12
0	3	3	0	6	2	8	2	4	0	12	0	8	0	4
0	4	5	12	6	3	0	3	4	1	4	0	8	0	12
0	4	4	0	6	2	8	2	12	1	0	0	8	0	8
0	3	3	0	6	2	8	1	8	0	12	0	8	0	4
low-cost good diet														
0	0	0	0	4	0	0	1	0	0	1	0	2	0	0
0	1	0	8	5	0	4	1	8	0	2	0	3	0	0
0	2	1	0	5	0	8	2	0	0	4	0	4	0	1
0	2	1	8	5	1	4	2	12	0	8	0	6	0	1
0	3	2	0	4	1	8	3	0	0	12	0	6	0	6
0	3	2	0	4	1	12	3	8	0	12	0	6	0	6
0	4	2	8	4	2	0	4	8	1	0	0	6	0	10
0	4	2	8	3	2	12	6	0	1	4	0	6	0	12
0	2	1	0	5	0	8	2	0	0	4	0	4	0	1
0	2	1	8	5	1	4	2	12	0	8	0	6	0	1
0	3	2	0	4	1	8	3	0	0	12	0	6	0	6
0	3	2	0	4	1	12	3	8	0	12	0	6	0	6
0	4	2	8	3	3	0	8	0	1	8	0	6	1	2
0	4	2	8	3	2	8	4	8	1	4	0	6	0	10
0	3	2	0	4	1	12	3	0	0	12	0	6	0	6
0	4	2	8	4	2	0	4	8	1	4	0	6	0	10
0	4	2	8	4	1	12	3	8	1	0	0	6	0	6
0	3	2	0	4	1	12	2	4	0	12	0	6	0	6

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[3] Count one and one-half pounds of bread as one pound of flour.

[4] Include white, brown, or maple sugars, sirups, molasses, iellies, preserves, candies, etc.

MENU AND MARKET ORDER FOR A FAMILY OF FOUR

The table of weekly Family Food Allowances prepared by the Bureau of Home Economics (on the preceding pages) lists the kinds and the amounts of food for good diets on three levels of cost for various members of the family. Based on this table a sample menu at a moderate-cost level has been planned. The market order for the menu is calculated for a hypothetical family of four with moderately active parents, a 13-year-old boy and a 9-year-old girl:

A Typical Daily Menu for a Family with Moderate Income

Breakfast

Sliced oranges
Ready-to-eat cereal with top milk
Scrambled eggs with bacon
Buttered toast
Coffee (milk for children)

Lunch

Cheese rarebit on saltines
Cabbage and green pepper salad
Stewed apricots Milk

Dinner

Tomato bouillon
Roast beef
Browned potatoes
Cauliflower with browned crumbs
Rolls and butter
Apple betty
Coffee (milk for children)

In actual practice the homemaker would not usually plan menus and do the marketing on a daily basis. For this reason, it is assumed that certain staple foods are on hand and other items would not be purchased for one day only. This sample menu and market order would seldom happen to fit an actual family situation because of likes and dislikes and extent of appetites. However, the market order does serve as a guide and vitalizes the two-page table of figures that on first glance appears uninteresting. It is suggested that the student plan a market order, using this menu to fit the needs of her own family.

MARKET ORDER FOR THE MODERATE-INCOME MENU *

(Family of four—mother, father, 13-year-old boy, 9-year-old girl)

Food	*Amount*
Milk	3 qts.
Cheese, cheddar	⅓ lb.
Potatoes	1½ lbs.
Oranges	4
Tomato juice	1 can (No. 2)
Cabbage	1 small head
Green pepper	1 small
Dried apricots	½ lb.
Apples	1½ lbs.
Cauliflower	1 med. head
Eggs	4
Beef, roast	4 lbs. †
Bread	¾ loaf (1 lb. loaf)
Shredded wheat	4 (1 oz. biscuits)
Crackers	2 ozs.
Sugar	½ lb.
Butter	⅓ lb.
Bacon	¼ lb.

* Not included in the market order are salt, other seasonings, vinegar, yeast, bouillon cubes, coffee, flour and fat other than butter and bacon.

† Approximately one third of this amount would be used for this menu.

Although it means more careful planning to provide an adequate diet at a low-income level, it can be done. The following menu shows how it can be achieved in an interesting and attractive fashion. No sample menu has been given for the expensive good diet because it is not so difficult a problem. The first section of the table prepared by the Bureau of Home Economics provides amounts for the expensive good diet.

A Typical Daily Menu for a Family with Low Income

Breakfast

Tomato juice
Cooked cereal with milk
Toast Jam Coffee (milk for children)

Lunch

Milk vegetable chowder
Crackers
Apple sauce Tea

Dinner

Stuffed shoulder of lamb
Baked potatoes Buttered beets
Bread and butter
Lettuce with French dressing
Snow pudding Custard sauce
Coffee (milk for children)

ECONOMY HINTS

When it is necessary to cut food costs to the minimum or when certain foods are not available, modifications can be made in the above pattern without interfering with the recommended food allowances in most respects. More economical cuts of meat or fish may be used or the meat serving may be reduced and other protein foods such as peanut butter or soybeans used instead. Canned tomatoes, raw vegetables, canned grapefruit juice or low-cost fresh fruits in season may be used instead of orange juice. A margarine reinforced with vitamin A may be used in place of butter, and it costs about half. Evaporated milk may replace all or part of the fresh milk; dry skim milk (fat-free milk solids) is even cheaper and a good source of all milk nutrients except the fat. Inexpensive cheese is also a good source of protein and other milk constituents.

Fresh greens in season and wild greens available in many areas may be used in place of more expensive green vegetables. Canned vegetables are recommended when fresh vegetables are not available. When buying canned fruits or vegetables, one should recognize that the nutritive value of the cheaper standard grades is not essentially different from the more expensive fancy grades and they are canned under just as sanitary conditions. In general, foods prepared at home are less expensive than foods purchased ready to eat. One good example is ready-to-eat cereal which is much more expensive than a cereal to be cooked. Thus the homemaker who is not employed outside the home may cut costs materially; but when time means more than money, prepared foods are useful and wholesome.

REVIEW QUESTIONS

1. Low-cost meals have to be planned with care to meet the recommendations. Which factors are most difficult to obtain in sufficient quantities in low-cost meals in your locality at the season of year when you are studying this chapter?

2. Choose any person of your acquaintance whose diet is restricted in certain foods and make the necessary substitutions to provide a diet that meets the recommended allowances.

3. Calculate the weekly market order, using the table prepared by the Bureau of Home Economics, for the following family: Father: 32, sawmill worker, 8 hours a day. Mother: 30, homemaker, does all the housework. Children: Boys aged 8 and 5, girls aged 4 and 2.

4. Select a family that you know with at least three growing children. Assume that they are on a liberal income and plan the day's menu and make out the market order.

13

Nationality Food Patterns

Chapter Topics

MODIFICATION OF NATIONALITY FOOD PATTERNS
DIETARY PATTERNS OF SPECIFIC GROUPS
  JEWISH
  ITALIAN
  HUNGARIAN
  POLISH AND SLAVIC
DIETARY PATTERNS (CONT.)
  ARMENIAN, TURKISH AND GREEK
  MEXICAN
  PORTUGUESE
  CHINESE
  PUERTO RICAN
  NEGRO

MODIFICATION OF NATIONALITY FOOD PATTERNS

One of the problems that the public-health nurse often faces is concerned with racial food habits. Our huge foreign population has come from all parts of the world and has brought a variety of dietary habits and tastes quite as fixed as our own. Dietary problems among foreign-born families are bound to arise because of the fact that foods that have been staples in their diet may now be expensive, while foods that have been considered luxuries are comparatively cheap. Sugar and white bread, for instance, are among the least expensive foods in this country, while milk, vegetables and fruit are often comparatively expensive. The public-health nurse will often have an opportunity to guide families of foreign extraction toward an adequate choice of food. Food customs and religious regulations must be considered when the nurse gives advice in regard to food selection. If the nurse considers these with understanding and sympathy, her aid will be valuable.

Upon examination of national dietary habits, it is found that the majority of peoples of the peasant class live sanely in their own countries, but on arrival in America they find conditions so changed from those of their own land that it is often difficult for them to make the necessary readjustment. Not knowing that one food is more valuable than another, or that certain things are essential while others are merely pleasant adjuncts, they are likely to choose their new diets unwisely.

In the past many of the immigrants who came to our shores were of the peasant, or farmer, class. Some had been accustomed to raising their own produce, to having their own goats or cows for the production of milk and the manufacture of cheese, their own chickens, ducks and geese, and their own fruit trees and vineyards. It is very difficult for them to realize that milk, for instance, can possibly be worth from 18 to 22 cents per quart, especially since they believe it to be a drink and not a food. Many of these peasants are also accustomed to goat's milk and find it difficult to make the change to cow's milk. Milk is, therefore, often one of the first foods on which the family economizes. The children may drink coffee or, possibly, tea in its place. On the other hand, second-generation families from southern European stock have adopted the use of milk, even for adults, although this was not the custom in their own country.

FIG. 31. Where coffee is not merely a beverage taken at meals but, as in Arabia, an essential part of every sale or bargain, other food habits may be expected to vary widely from our own.

Most of the nationality groups have, in their own countries, been accustomed to cooking vegetables with meat; but, here again, the price of vegetables seems exorbitant and therefore their use may be reduced far below what is necessary for health. In the majority of instances the great problem of the nutrition worker and the nurse is to teach these people the value of milk and vegetables in the diet and to assist in planning the budget so as to cover these two necessaries.

At the same time, the food must retain the essential characteristics of the national diet, particularly so as far as flavor is concerned. Foods must be relished and flavor has more to do with this than perhaps any other one factor. A person should be encouraged to keep that which is good in his native diet and to discard anything that may be bad. This means that the dietary customs must be analyzed and checked against the food standards that have been set according to the foods in general use in this country. Success in making necessary changes in the habits of a lifetime, which often extend through a second generation after a family has arrived in this country, depends upon the sympathy and the understanding of the problem. A woman of foreign birth may have little contact with the outside world and therefore little opportunity to learn how to use foods that are new to her. The marked improvement in the homes where the mother has had the opportunity to learn to adjust herself to American foods and customs shows that instruction is one of the important phases of nutrition work.

While the opinion was once held that the stature of certain races was due to climate, it is now generally believed that these racial differences are partially the result of differences in food. Holt further states that statistics show that Japanese children in the United States, both boys and girls, are taller and heavier than those of corresponding ages living in Japan; also that children of the successful and prosperous Russian Jews—those who have become to a considerable degree Americanized—are almost as large as those of our native-born population, the children frequently being four or five inches taller than their parents. However, no such results are seen among the very poor, where the mode of life and food has been little altered from that of the parents. While happiness, usefulness and even success in life are by no means dependent upon the height and the weight of the individual, a fine physical development is always desirable. A frail body or habitual poor health is a serious handicap in life.

In this chapter special attention is given to those food patterns that tend to be least like the typical American, because it is in such homes that the greatest adjustment has to be made. Food habits of peoples from the Scandinavian countries and western Europe are so much like those of America that there is little if any difficulty in making the adjustment. In fact, most of our American food habits are inherited from this group of countries.

A schematic picture of the food patterns of 13 European countries by Mitchell and Joffee [1] gives more details about foods and how they are used.

DIETARY PATTERNS OF SPECIFIC GROUPS

JEWISH DIETARY HABITS

Probably one of the most difficult dietary problems for the social worker is that of the Jew because of the many religious restrictions that are applied to the diet. However, it is a well-recognized fact that no social worker can afford to ignore the religious ideas or customs of a people, for confidence is the basis upon which all successful social work rests.

The following description of the dietary laws of the Jews is quoted from "Foods of the Foreign Born," by Bertha M. Wood and published by M. Barrows & Co., Boston, 1929; also from "Jewish Dietary Problems," by Mary L. Schapiro, "Journal of Home Economics," February, 1919:

1. PROHIBITED FOODS

Prohibition of Animal Foods. Absolute and partial prohibitions:

Unclean animals are absolutely prohibited. Clean animals all are quadrupeds that chew a cud and also divide the hoof. All others are regarded as not clean.

Products of animals that are suffering from some malady or that have died a natural death or had eaten poison are regarded as "terefah," unclean, and may not be used.

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[1] Mitchell, H. S., and N. F. Joffee: J. Am Dietet. A. 20:676, 1944.

All animal foods which are not obtained by killing in the prescribed manner and after adequate inspection by a duly authorized official may not be used.

Blood was regarded by the ancient Hebrews, and by many primitive peoples today, as the vital part of the animal which must be given back to God. Fish does not come under this category, possibly because it is a cold-blooded animal.

Fish that have fins and scales—none other—may be eaten. This would bar all shellfish, such as oysters or lobsters, as well as fish of the eel variety.

No scavengers or birds of prey are to be eaten. These are regarded as unclean.

The suet of ox, sheep or goat is forbidden (not the fat). Fat of birds or permissible wild animals is not forbidden.

An egg yolk with a drop of blood on it is considered as an embryo chick, and is forbidden.

2. Prescribed Modes of Preparing Food

The following partial prohibitions are fully as important as the above:

After the proper cut of meat is secured from the proper kind of animal which has been slaughtered in accordance with Jewish Law, it is to be soaked half an hour to soften the fiber and enable the juice or blood to escape more readily when salted. (The pan used for this purpose may not be used for anything else.) The meat is then thoroughly salted, placed on a board which is either perforated or fluted, and placed in an oblique position, so as to enable the blood to drain off. It is allowed to remain thus for one hour, after which time it is to be washed three times. The washing is for the purpose of removing all the salt. This process is called kosher and is regarded as very important.

Bones with no meat and fat adhering to them must be soaked separately, and during the salting should be placed near the meat.

Chops and steaks may be broiled.

The heart may be used, but must be cut open lengthwise, and the tip removed before soaking. This enables the blood to flow out more freely. Lungs are treated as is the heart. Milt must have veins removed. The head and feet may be koshered, with the hair or skin adhering to them. The head must have the brain removed. This latter is used, but must be koshered separately.

To kosher fat for clarifying, remove the skin and proceed as with meat. In preparing poultry, it must be drawn and the insides removed before putting into the water. The claws must be cut off before koshering. The head must be cut off. The skin of the neck must be either turned back or cut, so that the vein lying between two tendons may be removed.

Seething a kid in its mother's milk is forbidden. This is the origin of the prohibition against the cooking of the meat and milk together, or of the eating of such mixtures. This rule is rigidly adhered to, and in its present application necessitates the use of a complete double equipment of dishes and utensils. Since this rule is regarded as one of the most important, one can understand why such sauces as butter sauces or white sauce are refused at meals with meat. This rule occasions the home-economics teacher considerable trouble in planning menus.

Meat and fish should not be cooked or eaten together, for such a mixture is supposed to cause leprosy. The mouth has to be washed after eating fish and before meat may be eaten.

3. Jewish Holidays

Sabbath: No food may be cooked on the Sabbath. This means that all cooking for both days is done on Friday. This need has led to the development of foods such as Sabbath Kugel or Sholend, Petshai, and many others.

Passover: During Passover week no leavened bread or its product, or anything which may have touched leavened bread, may be used. This restriction holds for eight days. In every Jewish home a complete and most thorough system of cleaning precedes this holiday. No corner escapes a scrubbing and scouring, lest a particle of leaven, or what is just as bad, a particle of food which may have touched leavened bread, should be found. A complete new set of dishes is used during the week. Cutlery, silver, or metal pots may be used during this holiday if properly koshered or sterilized. The usual method of doing this is to plunge red-hot coals into boiling water, and then to immerse the desired utensils. These or any other Passover utensils may be used after the holiday is over without rekoshering, but once used without Passover precautions they are unfit for Passover use unless rekoshered. In actual practice this means that in every orthodox Jewish household there are four sets of dishes—the usual set for meat and the set for milk food, in addition to duplicate Passover sets. The Passover dishes are stored away very carefully, lest some leaven come near them.

Because of the need for abstaining from leavened bread during Passover, many interesting dishes have developed, such as the Mazzah Klos (dumplings), soup, cakes and puddings made of the mazzah meal. Almond pudding and cake are very popular. Almost all of the food cooked during this holiday requires the liberal use of shortening or fat, with great danger of a too liberal use for health, as well as from the economic point of view. The fat generally used is either goose or chicken drippings, or clarified beef fat other than suet.

Fast Days: (A) Yom Kippur (the Day of Atonement). No food or drink may be had for 24 hours. (B) Fast of Esther. This precedes the Feast of Purim and is now observed only by the very pious. The Feast of Purim is universally observed.

Semifast Days: Eight days in Ab. For nine days no meat food may be eaten by the orthodox.

A striking characteristic of the Jewish diet is the richness of the food, including pastries and cakes, foods rich in fats, and preserves and conserves, as well as stewed and canned fruits. Pickles and "sours" are also used abundantly. No pork or pork products are used. Meat and milk may not be served in the same meal. Butter, being a product of milk, may not be served with meat. Most vegetables, therefore, are cooked with the meat. Cooked vegetables are more often served in soup than otherwise. Borscht, a soup made with "sour salt" (tartaric acid) and vegetables to which sour cream is added, is a favorite dish but is not served with the meat meal. This limits the amount of vegetables used, although the salad vegetables—lettuce, cucumbers, tomatoes and scallions—are served quite frequently, either plain or with sour cream. Cereals, especially barley and buckwheat (kasha), are served as a vegetable with meat or in soup, either in a meat stock or cooked in milk.

Noodles and other egg-and-flour mixtures are used quite extensively.

Rye and whole-wheat breads are well liked, as well as crusty rolls.

Dried fruits, as well as fresh, are used by those who can afford them.

Fish is served quite frequently, especially cod, haddock, carp, salmon and white fish, as well as the smoked and the salted fishes—herring, salmon and sturgeon. Gefüllte fish is a delicacy prepared in almost all Jewish homes. Chicken is considered almost an essential for the Sabbath evening meal.

"In prescribing diets for the Jewish people, it might be helpful, both to the person who prescribes and the patient for whom the diet is prescribed, to remember that all their foods may be classified under three heads: (1) Meat or fish; (2) milk and its products; and (3) neutrals. Meat and milk are never mixed. Neutrals may be used with meat or with milk products, but never with both in the same meal."

Because milk in any form cannot be served with meat at the same meal, the diet of Jewish children often lacks the proper amount of milk. The use of more milk for the children, more green vegetables and canned vegetables and fresh and canned fruits for the whole family should be stressed. The continued use of rye bread, legumes, coarse cereals, dried fruits and a variety of fish which are characteristic of the Jewish diet is advantageous.

ITALIAN DIETARY HABITS

The Italian immigrants, who come from northern and central Italy, are chiefly farmers. Italy has much the same climate as that of California, consequently fruits and vegetables are there grown in abundance and freely used. Goat's milk is used, especially for the children. Cheese is also made from it and used freely. Eggs are in common use. Macaroni is made in various forms and used in many dishes, "maccheroni" being the national dish. Macaroni is only one variety of the paste, "pasta" made from flour, dried in the open air, and sold by the pound. Dark bread made from the whole wheat is a standby. Approximately 40 per cent of the native Italian diet is from wheat in some form, and from 60 to 70 per cent from grain and potatoes combined, the root vegetables being used more in the north than in the south of Italy.[2] Olive oil or lard is used in various ways in cooking. Very little meat is used by the average Italian. In southern Italy, where fishing is one of the chief occupations, fish is used extensively. Garlic and green peppers are used abundantly. The food is more highly seasoned in southern Italy than in other regions. Liquor of some kind is popular among Italians. Wine is used almost everywhere, except in the north, where stronger liquors are usually made and served.

The Tuscan and the Umbrian peasantry live almost exclusively on the "minestra," which word is usually translated "soup," made of vegetables with meat stock. On gala occasions noodles or rice are added and grated cheese is always sprinkled thereon.

A typical Italian breakfast consists of black coffee for adults, milk for children, and bread without butter. The noonday meal consists of bread, cheese and black coffee with perhaps one of the many kinds of sausages, or, if the meal is taken at home, fried eggs may be served. The evening meal is the principal meal of the day, since the family are often working in the fields or away from home at midday. The menu at this meal is a little more varied, although it usually consists of one dish. Meat or beans often serve as a basis. The cooking of this dish is started in the morning. Later on, vegetables are added and still later macaroni and the fat, which may be lard or olive oil. Polenta, a thick cornmeal mush, to which tomatoes, cheese or a bit of pork and garlic have been added, is another favorite dish, and bread and butter are served with this dish.

The Italian immigrant finds coffee in America cheaper than in his own country and it is not uncommon to find the children partaking of this beverage in place of milk. The Italian buys food in small quantities, such as the breast of a chicken or merely one wing, using such pieces to flavor a whole dish. As there are few refrigerators, perishable food is never provided in great abundance.

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[2] Bennett, M. K.: Food for Postwar Europe, Food Research Institute, Stanford Univ. Press, War-Peace Pamphlet No. 5, 1944

The Italians have many kinds of cheese, which are used freely. However, they have a strong aversion to American cheese and an investigation conducted in New York disclosed the fact that when Roman cheese cost $1.25 a pound, it was considered such an essential that in the poorest Italian homes, where the investigator found the family suffering from the cold and the lack of food, it was still being purchased in small quantities. However, a taste for sweets is rapidly acquired in this country, the children eating a great deal of candy between meals. This, together with too much coffee and too little milk, is the most difficult phase of the nutritional problem among Italian children. The trend in recent years has been toward more milk both for children and for adults as incomes became more adequate and education in the value of milk more widespread.

While the use of green vegetables and fruits in the Italian diet is to be commended, there should be encouragement in the use of milk, coarse cereals, root vegetables and potatoes. Candy between meals and coffee for the children should be discouraged.

HUNGARIAN DIETARY HABITS

In the native Hungarian diet between 50 and 60 per cent of the calories are from grains and potatoes. Pork, either fresh or cured, is the favorite meat, especially in rural areas.

Hungarian foods are as a rule more highly seasoned than the average European dishes. Paprika is used freely as a seasoning, likewise onions and fresh peppers, both green and red. Sour cream is used both as a sauce and in certain cooked foods. Sauerkraut is popular. Fish and shrimp are well liked and used frequently. Eggs are used extensively and fruits are particularly well liked. The use of more raw vegetables and improved methods of cooking vegetables should be encouraged, as should the use of more cereals and milk.

POLISH AND SLAVIC DIETARY HABITS

Potatoes and bread are major items in the Polish food pattern, grains and potato together providing from 60 to 70 per cent of the total calories. Rye and buckwheat flour are used freely. Course cereals may be cooked in milk but are rarely served with milk. Potatoes are eaten at almost every meal. Pork and pork products, especially sausage, highly seasoned, are popular, but meat of any kind is a luxury in rural areas. Fresh, salted or pickled fish are favorite foods. Cabbage may be used raw, as kraut or cooked, and most vegetables are cooked with meat. Sour cream and cottage cheese are used extensively.

The use of more milk (particularly for the children), of more raw vegetables and of more fruits should be encouraged. These people might profitably increase the use of canned tomatoes, in winter, a custom only recently accepted in Europe.

ARMENIAN, TURKISH AND GREEK DIETARY HABITS

The people of the Near East are an outdoor people. Most of them are farmers: they raise their own sheep, goats, cattle, chickens, ducks and geese; they produce their own grains and grow fruits and vegetables in abundance. The whole grain, usually wheat, is parboiled and cracked for use as the staple starchy food at the main meal. Grains furnish the major source of calories. Eggs, butter and cheese are also produced on the farm. Lamb is the favorite meat. The food is not highly spiced but is rich in fat. The fat is cooked with the food and this serves in place of butter. Matzoon, or Yoghurt, a sour-milk preparation, is used almost universally by these people; sweet milk is seldom used. Black coffee, in which the pulverized bean is retained, is the preferred beverage.

Mexican Dietary Habits

The Mexicans use freely many varieties of beans, as well as rice, potatoes, peas and some vegetables. Chili, a variety of pepper, is also popular. The chili plant is sacred to the Mexican, who is supposed to be blessed in health if he uses it plentifully. The tomato is always prominent in Mexican cookery. Mexicans use little meat and practically always cook it with vegetables. They have a strong aversion to meat that is not perfectly fresh and slaughtered in the approved Mexican style. Chile con carne is a favorite meat dish. It consists of beef seasoned with garlic and chili peppers and cooked several hours. Tamales are also popular. They are made of corn meal and ground pork, highly seasoned, are rolled in corn husks and steamed. Tortillas, made with ground whole corn which has been soaked in lime water and baked on a griddle, furnish the bread. The lime provided in this fashion supplies some calcium which otherwise would be almost lacking in the diet which does not usually contain milk or cheese. The use of milk for the children should be encouraged and if a change to the American type of bread is made, it should be of the whole-grain or enriched type.

Portuguese Dietary Habits

The dietary habits of the Portuguese are similar to those of the Mexicans. Their consumption of wheat products is lower than that of any other southern European country, but use of grains other than wheat is liberal. They use many spices and peppers; allspice and mace are favorites.

Chinese Dietary Habits

The Chinese diet is varied, consisting of eggs, meat, fish, cereals and a large variety of vegetables. Many plants and weeds, such as radish leaves and shepherd's purse, are used, as well as various sprouts (bean, bamboo, etc.) that are usually not considered edible in America. The soybean is grown abundantly, as some 30 or more products are manufactured from it. The protein content is very high and of good quality.

Rice is used freely and takes the place of American bread, particularly in southern China. In northern China, wheat, corn and millet seed are used in abundance. The millet seed (ground or whole) is made into cakes or a thin mush, the latter being the form in which it is given to children. Noodles are largely used. Grains and, in some areas, sweet potatoes constitute the chief source of calories in the Chinese diet; grain and potato together provide from 70 to 90 per cent of the total calories.

The quantity of meat eaten is small and it is usually served with vegetables. These are cut into small uniform pieces in conformity with an ancient law laid down by Confucius, the philosopher, specifying that food should not be eaten unless it had first been chopped or cut into small pieces. Pork is the chief meat of the poorer classes. Lamb may be substituted for pork, but beef is more or less sacred. This religious belief has eliminated milk almost entirely from the Chinese diet, and, with few exceptions, the ordinary Chinese child and adult rarely tastes cow's milk, although buffalo milk is used to some extent in certain parts of China. Cheese is an unknown factor in the diet.

The Chinese use practically every part of the animal as food (with the exception of the hair and the bones); even the brain, the spinal cord and the various internal organs, as well as the skin and the blood, are utilized. Coagulated blood is sold on the market in pieces similar to liver and, since this is one of the inexpensive foods, it is used freely. Fish and shellfish are also in common use. They are sold alive, for the Chinese have a strong aversion to dead fish and consider them unfit for food.

Eggs, including hen, duck and pigeon eggs, are used in abundance, when they can be afforded. The Chinese prepare what is known as fermented eggs, which are much relished by them, as well as other types of "preserved" eggs, which are eaten much as we in this country eat sweets.

Puerto Rican Dietary Habits

Puerto Rican dietary habits are not unlike those of Mexico and other Latin-American countries. Rice and beans are the staple foods and salt codfish is well liked. Pork is the favorite meat. Sweet potatoes and a variety of root vegetables, which may be obtained in markets in seacoast cities which have Latin-American colonies, are largely used. Fruits such as bananas and oranges are well liked but considered expensive in this country. Because of the absence of milk in the native diet a large amount of malnutrition is often found among both children and adults.

Negro Dietary Habits

The transplanting of the Negro from the South and from the West Indies to a northern climate brings many dietary problems. Money is often scarce and is spent for foods that are filling rather than for vegetables and fruits, milk and eggs, which it was often possible to procure inexpensively or to produce in a warmer climate. Rickets and other nutritional diseases are common among the children. The use of milk, whole-grained cereals, vegetables and fruits and the continued use of molasses should be encouraged.

REVIEW QUESTIONS

1. The public-health nurse should be able to adjust her advice on nutrition to various nationality food patterns. For which European peoples will there be the least variance from the American pattern?

2. The essential characteristics of a national diet should be retained, although some modifications will be necessary on account of available foods. What sort of guide should be used in making these substitutions?

3. The opinion was previously held that stature was dependent upon climate and inheritance. What modern evidence is there to the contrary?

4. The Jewish diet is one of the most difficult problems of the social worker or public-health nurse. List some of these problems.

5. How do the uses of grains, potatoes and meats vary in the following countries: Italy, Hungary, Poland, Greece, Armenia, Turkey and Portugal. On a map of Europe note the relative location of these countries.

14

Food Hygiene

Chapter Topics

INTRODUCTION
ILLNESSES TRACEABLE TO FOODS
  CHEMICAL POISONS IN CERTAIN FOODS
  FOREIGN CHEMICALS IN FOODS
  DISEASE-PRODUCING ORGANISMS
CONTROL OF SPOILAGE AND DISEASE TRANSFER
  REGULATION OF TEMPERATURE
    LOW TEMPERATURES
    HIGH TEMPERATURES
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CONTROL OF SPOILAGE (CONT.)
  REGULATION OF MOISTURE OR DRYING
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LEGISLATIVE CONTROL
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INTRODUCTION

The dependence of health upon the quality and the quantity of the food supply has been emphasized in the preceding pages. In this chapter various factors that affect food quality and quantity are considered briefly. To avoid food spoilage and food-borne disease, sanitary and efficient methods of food production, transportation, storage and final food handling or service must be assured. Important also are the peculiar dangers associated with certain foods—for example, mushrooms—and the occasional accidental introduction of poisonous substances, as in the use of insecticide sprays and cyanides in silverware polish.

Nurses and dietitians should feel confident that the foods they provide will help their patients in the struggle to regain health and will not add to their difficulties.

ILLNESSES TRACEABLE TO FOODS

Difficulties that occur in certain individuals supersensitive to specific foods, such as milk and eggs, are discussed in a later chapter on allergy. Three causes of illnesses sometimes traceable to foods remain to be considered here: (1) Chemical poisons present in certain plants and animals; (2) foreign chemicals sometimes accidentally introduced into foods; and (3) disease-producing organisms.

CHEMICAL POISONS IN CERTAIN FOODS

Mushroom poisoning is the most familiar example of illness due to poisons occurring naturally in certain foods. Few individuals are expert enough to distinguish poisonous mushrooms from the edible types, and institutions should serve only the types grown in quantities by commercial producers and sold either fresh or canned.

A few plants used as foods are safe at one time and not at another. The young white shoots of pokeweed are frequently eaten with safety as "greens" in the early spring, but the later green shoots may cause severe illness. The green leaves of rhubarb may also cause illness, but the succulent leaf stems are eaten without any untoward effects. Green parts of white potatoes may contain enough solanin to cause illness and even death. Animal tissues, such as the livers of certain wild animals, may be poisonous to man; although the livers of domestic animals are edible and the livers of halibut and cod are used widely for their vitamin A content. The animal food most often responsible for illness is probably mussels from the Pacific coast. These are reported irregularly as causing gastrointestinal complications.

Milk sickness or "trembles" of cows is due to the eating of a poisonous plant, white snakeroot, and the milk or butter from cows so afflicted may contain enough of the poison to cause acute illness in man.

FOREIGN CHEMICALS IN FOODS

Foreign chemicals may be introduced accidentally into foods in various ways. The use of agate and aluminum cooking vessels is not considered dangerous, though glass is preferable to either for prolonged cooking and for storing highly acid foods (tomatoes, rhubarb). Cadmium, when used as a substitute for aluminum in cooking utensils, has caused severe intestinal disturbances.

Food poisoning may result from fruits and vegetables treated with chemicals, especially lead and arsenic, to control molds and insect pests. Illness has been caused by cider due to arsenic on unwashed apples. Growers are sometimes required to wash hardy fruits, such as apples. It is obviously impractical to wash such perishable fruits as berries before transportation, and thorough washing with several changes of water should be the general practice in homes, restaurants and hospitals. Where possible, harmless substances such as whitewash-soapsuds spray against Japanese beetles should be used.

The Food and Drug Administration "does not take action on apples and pears containing not more than 7 milligrams of DDT per kilogram of fruit," considering it preferable to the chemicals that might otherwise be used. The sudden popularity of DDT for use in homes and in institutions warrants a warning against allowing sprays (solutions or powders) to reach foods, utensils or surfaces used in food preparation, for "DDT is a poison and should be treated as such." The powder form should be labeled to prevent confusion with flour and baking and milk powders, for it is estimated that a teaspoonful would be fatal to man. DDT is a skin irritant but it is less poisonous to man than the widely used sodium fluoride powder.

Virus or bacterial poisons against vermin are always dangerous and should not be used in or near houses, if at all. In one college outbreak over

100 cases of illness were caused by rat poison of this kind. In some states (New York) the use and the sale of virus and bacterial poisons are prohibited.

The potassium or sodium salts used in curing meats are not harmful in the amounts used. Sodium benzoate is usually limited to 0.1 per cent; the only federal restriction is that the amount must be indicated on the label. Sulfur (sulfur dioxide or sulfurous acid) used to prevent darkening of cut fruits (dried apples, peaches, apricots and pears) is not generally considered harmful in the amounts customarily used, but thorough washing of the fruits before use is desirable. Sulfur is not now considered commercially advantageous for drying whole fruits (prunes, figs, most raisins), although it is sometimes used during the storage of fresh grapes. No objection is made to the use of such volatile chemicals as methyl bromide, now widely used to prevent spoilage of grains, etc., during storage. Poisons such as the cyanides, sometimes used as polishes (table silver), may cause illness and even death. Enough cyanide may remain upon an incompletely rinsed fork to cause acute illness and cyanide polishes are illegal in some states.

Disease-producing Organisms

Food-borne diseases are caused by a wide variety of organisms, ranging from large tapeworms down to the minute viruses, as in intestinal influenza. The specific cause of the disease is sometimes indicated by the name of the illness: the typhoid bacterium in typhoid fever or the brucella bacterium in brucellosis (undulant fever). Often, however, such general names as gastro-intestinal disturbance and food poisoning are used in connection with very different causal organisms, such as staphylococcal, dysentery and salmonella bacteria, as well as for attacks due to chemical poisons.

Food-borne infections may be transmitted from the lower animals to man, as well as from man to man. The list of human diseases known to have been transmitted through foods is a long one and includes diphtheria, the common cold, tuberculosis, scarlet fever, streptococcal or septic sore throat, amebic dysentery, typhoid and paratyphoid fevers, bacillary dysentery and other types of dysentery and food poisoning due to staphylococci as well as to dysentery and salmonella bacteria.

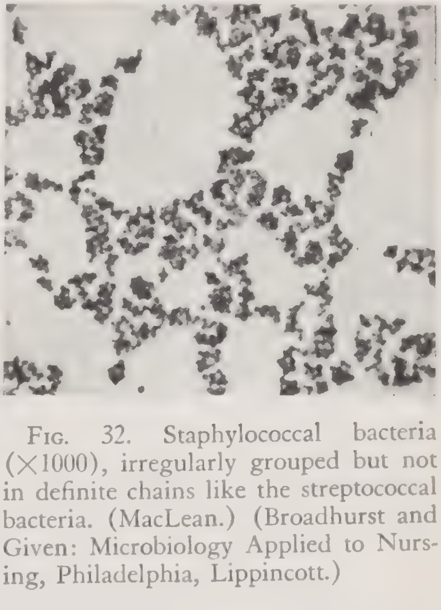

Fig. 32. Staphylococcal bacteria (×1000), irregularly grouped but not in definite chains like the streptococcal bacteria. (MacLean.) (Broadhurst and Given: Microbiology Applied to Nursing, Philadelphia, Lippincott.)

Among the animal diseases transmissible to man through foods are tuberculosis, brucellosis (undulant fever), botulism, foot-and-mouth disease, several types of dysentery and salmonella infections and worm diseases, such as tapeworm and trichinosis. Foot-and-mouth disease was eradicated from the United States by

1926, and keen inspection has since been maintained to prevent its introduction in hoofed animals. At present, much concern is felt over the existence of foot-and-mouth disease in Mexico. On December 31, 1946, our Department of Agriculture put a quarantine on livestock from Mexico. Botulism in man has been traced to animals (limber neck in chickens and keel disease in ducks), but the transmission is through plants contaminated by soil containing the organisms rather than by animals. In some diseases, such as tuberculosis which has a high personal contact rate, it is not possible to state when cases are food-borne except in investigated outbreaks. Nevertheless, the relative importance of food transfer in diseases known to be food-borne is suggested by the cases given in the preliminary report of the U. S. Public Health Service for 1945. In round numbers they are bacillary dysentery, 34,600; other types of dysentery (and gastro-intestinal disturbances), 11,000; septic sore throat, 10,000; typhoid and paratyphoid fevers, 5,600; brucellosis, 5,000; and trichinosis, 250. The relative infrequency of botulism and food-borne worm diseases is indicated by their omission from this report.

CONTROL OF SPOILAGE AND DISEASE TRANSFER

Molds and bacteria cause immense losses in food supplies during production, transportation and storage in wholesale and in retail plants, as well as in the home. Even when the spoilage does not cause total loss of a given food, it may mean changes that make the food less palatable and even unacceptable. Foods furnish rich nutritive materials for molds and bacteria, and since most foods also contain sufficient water to allow micro-organisms to develop, very definite measures are usually necessary to protect foods from such destructive changes as fermentation (fruits) and putrefaction or decay (meats, eggs and other protein-rich foods). Fortunately, the methods man has developed to conserve his foods have tended to make them safe; for example, appropriate cold storage kills trichinella and tapeworms, and canning under pressure destroys even the resistant spores that cause botulism.

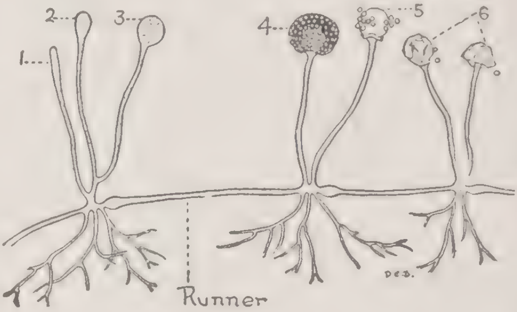

Fig. 33. Ordinary "black mold" or "bread mold." The numbers indicate progressive stages in the formation of the spore cases and the ripening and the distribution of the spores. New generations, each with dozens of spore cases, may mature every three or four days. (Broadhurst and Given: Microbiology Applied to Nursing, Philadelphia, Lippincott.)

Some methods of controlling spoilage aim to produce as little change as possible in food flavor and in texture, as in the cool storage of fruits and in the ultraviolet-light treatment of bread to reduce mold growth, while other methods, such as preserving, cause decided changes both in flavor and in texture. The three main methods of control are regulation of temperature, regulation of moisture and chemical action.

REGULATION OF TEMPERATURE

Appropriate low and high temperatures are used to control spoilage and inhibit or destroy disease organisms.

LOW TEMPERATURES

By suitable low temperatures we are able to conserve foods for prolonged periods, distributing seasonal foods throughout the year and gaining foods from distant regions. Both cool storage and freezing or cold storage may be chemically conditioned or reinforced by ultraviolet light (Rentschler lamps) or by chemicals—for example, ozone with eggs and carbon dioxide with meats.

Cool Storage. By utilizing temperatures low enough to slow changes in foods due to their natural enzymes and to inhibit the action of molds and bacteria, foods that are in good condition when they go into a modern cool-storage plant where temperature and humidity are properly controlled will remain in excellent condition for prolonged periods. Refrigeration practice has now definitely established limits of temperature and time for such perishable foods as fruits and vegetables. As illustrations of the wide range used for cool storage, we might cite such recommendations as the following, although practices vary in different storage plants: Butter, 0° F., keeps for months; melons, 31-32° F., 6 weeks; oranges, 32-33° F., 3 months; beans, string, 33-34° F., 1 month; cucumbers, 40° F., 10 days; and bananas, 50-60° F., for months. In cool storage of fruits and vegetables the temperatures must not fall below the freezing point of the food. This is usually below the freezing point of water (32° F.), and, therefore, the cool-storage temperatures may be one or more degrees below 32° F.: cauliflower at 30° F., carrots at 29° F. and some varieties of sweet corn at 28° F.

Cold Storage. Cold-storage temperatures are lower than those used in cool storage and permit of more prolonged storage periods. For freezing foods, temperatures as low as −5° to 20° F. are recommended, and they are attainable in deep-freeze units now available for home use. Quick freezing by the Birdseye process utilizes even lower temperatures (−35° F.). The ice crystals formed in quick freezing are much smaller (though more numerous) than in slow freezing; the cells of fruits, vegetables, etc., are injured less by these smaller crystals and the texture of such foods is, therefore, more normal than in slow freezing. Over 50 kinds of food are now retailed in frozen or "frosted" form, varying from fragile berries to shelled eggs and whole chickens.

Not only does cold storage delay or inhibit ordinary storage changes in foods, but at specific temperatures it may protect against such parasites as trichinella and tapeworm. Trichinella are destroyed at 5° F. or −15° C. in from 20 to 30 days, or at −18° C. for 24 hours. As a safety factor, cold storage at −15° C. for 20 days is required by the U. S. Bureau of Animal Industry.

Bacteria and mold spores are often very resistant to cold, not only the spores, but the vegetative forms. It has been shown experimentally that typhoid bacteria that do not form spores may persist for months in ice cream. Frozen fruits and vegetables often contain surprisingly large numbers of bacteria and molds. Therefore, special attention must be given to the quality of the foods selected for freezing, and they should be frozen in small units or packages to ensure prompt chilling throughout the whole mass. Since the cells or the tissues of fruits and vegetables are always injured somewhat by freezing, even in the quick-freezing processes, they are subject to greater bacterial decomposition after thawing. Therefore, frozen foods should be kept frozen until they are to be used; thawing and refreezing should not be practiced. Automatic records of temperature are necessary to safeguard frozen products.

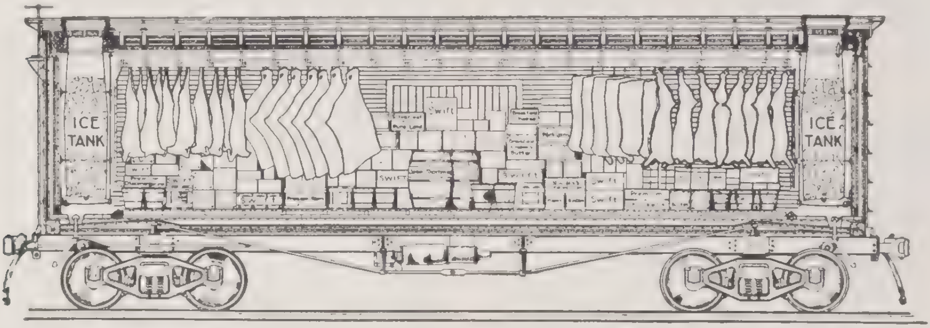

Fig. 34. Interior view of a loaded, modern refrigerator car. (Swift and Co., Public Relations Department.)

Some experts recommend that frozen foods be transferred in that state directly to the cooking utensil; others advise thawing in air by an electric fan or in the warmer shelves of the refrigerator. If thawed before use, it is recommended that they be thawed in the original wrapper, to prevent contamination and to avoid color changes due to oxidation, as in frozen peaches. Vegetables usually require less cooking time when frozen than when fresh. Precooked frozen foods are now on the retail market in some places and a big future is predicted for them.

In addition to the huge freezing plants operated by the large commercial companies, well over a million private and community cold-storage lockers are now in use. The rapid increase in small-scale production of frozen foods emphasizes the need for care in the selection of foods and their cleanly handling. Some locker plants help in this care by providing space for preparing and precooling the foods before they are placed in the freezing units.

HIGH TEMPERATURES

High-temperature methods include pasteurization (discussed under Milk later in this chapter), boiling and other common methods of cooking (frying, roasting), and cooking under pressure, in pressure cookers. The action of heat is increased by the presence of certain chemicals, such as the acids present in certain fruits or due to the addition of vinegar.

Boiling temperatures (100° C. or 212° F.), if maintained long enough, will kill most micro-organisms, but some bacteria, as well as molds, produce spores that are often very resistant to heat and are killed only when much higher temperatures are used.

For some fruits, especially the very acid ones, boiling for from 10 to 12 minutes is sufficient to kill the bacteria present, as acid makes a given temperature more effective. Some vegetables require heating for much longer periods: prolonged heating is always recommended for foods such as corn, which packs solidly and delays the passage of the heat into the interior of the can, and for vegetables, such as bush beans, which grow close to the ground and are likely to carry spore-bearing organisms from the soil. In such cases, temperatures well above 100° C. are often necessary to kill the spores. This explains why government bulletins discourage home canning of nonacid vegetables unless higher temperatures are secured by a pressure cooker.

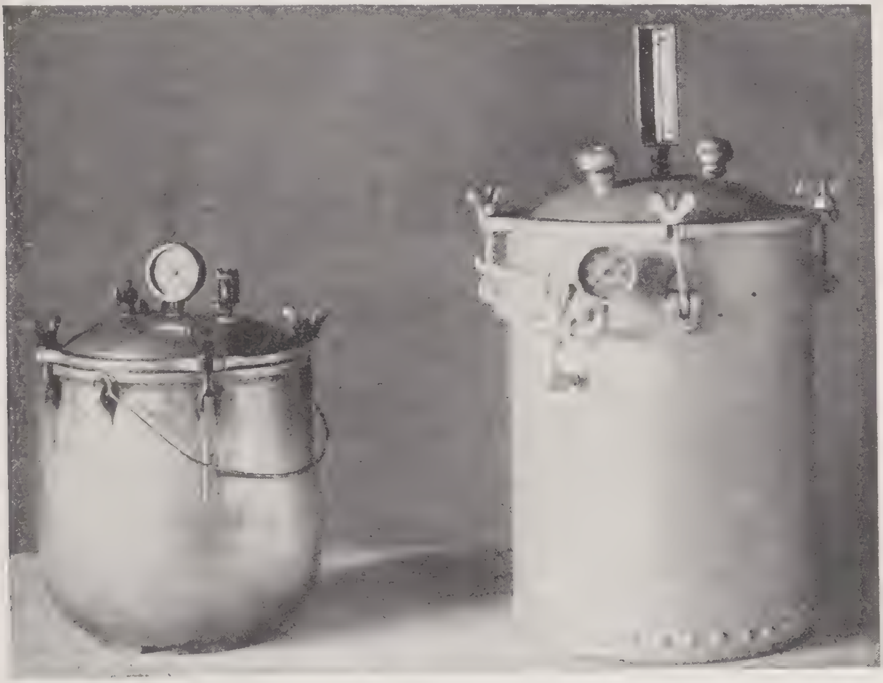

FIG. 35. Two types of pressure cookers for canning meats or cooking vegetables, especially when the aim is to secure very soft fibers or texture in a short time. Smaller types are now widely used in the home. (U. S. Dept. of Agriculture.)

Increasing the temperature by confining the steam, as in a pressure cooker, gives temperatures above boiling which destroy organisms and their spores more rapidly and certainly than boiling. Commercial canneries use steam-pressure retorts entirely. If the heat is not sufficient in degree or is not continued for a sufficient period, some of the bacteria or their spores will not be killed; in which event they may multiply and cause such spoilage as "flat sours" and "swells" (swollen tins), due to gas accumulation, and even the development of toxins, due to botulinus bacteria.

BOTULISM

The toxin produced by the botulinus bacteria is so poisonous that even a "taste" of the contaminated food may be fatal. Any canned food that has a bad odor or that shows any signs of deterioration should be rejected without the usual test of tasting. It is not impossible for botulinus toxin to be present in foods that show no signs of deterioration. Since this toxin is destroyed by heat, some authorities recommend that all home-canned vegetables, meats and soups be boiled from 5 to 30 minutes, the more solid foods receiving the longer boiling. Some individuals carry this precaution so far as to boil every canned product, even pears, peaches, etc. As stated above, when food seems "suspicious" it should be discarded; reliance should not be placed upon boiling for protection. The botulinus organisms are found in soil, as well as in the intestines of animals, and, since the spores are very resistant to heat, canners in homes and in factories should wash the vegetables thoroughly, cook them promptly while still fresh and store the canned goods in cool places, so as to discourage the growth of any possible surviving spores. Apparently the botulinus organisms do not form toxins in the intestine. Therefore, proper handling and cooking of foods will ordinarily prevent botulism. It is not a common disease in this country; in fact, it is so infrequent that it is not included routinely in the bulletin, "Notifiable Diseases," issued yearly by the U. S. Public Health Service. Nevertheless, the precautions mentioned should be observed, especially in areas where botulism has been reported.

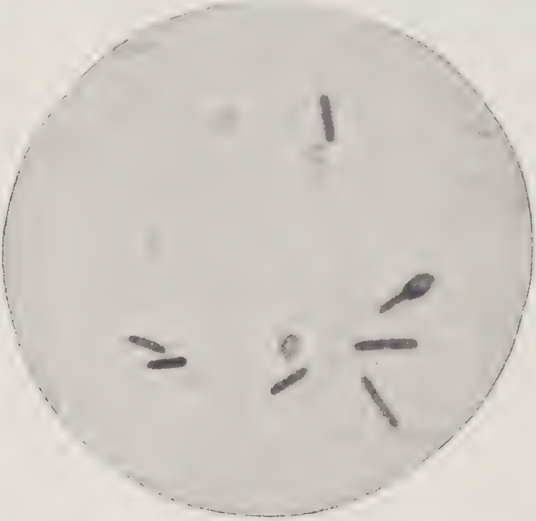

Fig. 36. Clostridium (Bacillus) botulinus, showing spores as well as the rods or vegetative form. This organism sometimes forms toxins in foods that are incompletely processed and causes the disease botulism.

Regulation of Moisture or Drying

Drying, the most ancient method of preserving foods, is still used extensively for fruit, vegetables, fish, and even meat. Many foods become discolored in drying, especially when dried slowly (without heat, vacuum method); and chemicals (sulfur) may be used to minimize color changes, as in drying apples. In foods containing fats (dried milk and eggs) the fats may become rancid due to oxidation changes, and the foods become "spoiled" or changed in flavor without real bacterial or mold spoilage or known danger to health. The low fat content of dried skimmed milk explains why it keeps better than dried whole milk.

The two world wars gave a great impetus to the production of dehydrated foods because their decreased bulk was a great aid in transportation and in storage. Immense quantities were produced, many in flake or powder form. When water is added preparatory to use, the directions regarding time and temperature must be observed to ensure palatability and good texture.

CHEMICAL ACTION

Ultraviolet light is sometimes used commercially in food-production plants, either alone or in connection with refrigeration. The final "five-second electronic treatment" of wrapped bread and other packaged foods to inhibit mold spoilage utilizes radio-like high-frequency power to heat metal plates and yields more rapid "through heating" of opaque or solid substances than can be obtained with ultraviolet light.

Chemicals, such as sulfur, are valuable in protecting foods such as dried apples which contain sufficient water to allow growth of bacteria and molds. In such cases limits are set to prevent the sale of fruits with an undue water content which would defraud the customer. (See Foreign Chemicals earlier in this chapter.) Familiar chemicals are "smoke" containing creosote and related products used in preserving meats, and salt used in pickling certain vegetables and meats. In making sauerkraut, salt is used in the proportion of 2 or 3 pounds to 100 pounds of cabbage. The salt limits the growth of ordinary spoilage organisms but allows the growth of bacteria causing lactic-acid fermentation. The bacteria causing this fermentation are almost universally present in the air and upon objects round about and are easily cultivated in suitable food, such as the vegetable juices drawn out by the salt. The accumulating lactic acid usually prevents the growth of other micro-organisms and gives to the cabbage the peculiar flavor so much desired by connoisseurs of sauerkraut. Vinegar added to foods helps in much the same way as the lactic acid formed through fermentation. Spices probably help limit the growth of micro-organisms, but their effects are usually slight; the percentages usually quoted—for example, 5 per cent of mace or ginger—are much too high for edibility. Many spices contain numerous bacteria—sometimes as many as a million bacteria per gram of dry weight. Onion and leek vapors have some slight inhibiting value, as has the filtered juice, when bacteria are subjected directly to them. There is no action by their cooked juices. Sugar, like salt, limits the growth of micro-organisms; high concentrations are sometimes used, as in dried foods such as dates. The addition of chemicals by meat markets to such foods as chopped beef to delay spoilage is wholly indefensible. (See Foreign Chemicals earlier in this chapter.)

SPECIAL FOOD CONSIDERATIONS

MILK AND MILK PRODUCTS

Milk demands the best hygienic care that can be given any food, primarily because it forms such a large part of the diet of children and an essential part of the diet at all ages.

The character of milk is indicated

by the bacterial count. If a large number of bacteria are found in fresh milk that has been properly cared for during milking, it indicates a diseased udder or unclean conditions in the later handling of the milk. To prove the safety of milk it is necessary to apply tests showing the absence of such disease organisms as tuberculosis bacteria, as well as to determine the number of bacteria present. Milk that contains a large number of gas-forming organisms is not considered desirable for human food. In some municipalities the bacterial count from the various distributors is published regularly. Rarely, however, is information given regarding the kinds of bacteria present, for this would be too expensive for routine work, and dependence is usually placed on the total number of bacteria—for example, not more than 30,000 per cc. in pasteurized milk.

Pasteurization—named for Pasteur as it is based on his method of heating wine and beer to reduce undesirable organisms—consists of heating milk to a temperature that will kill any pathogenic organisms that might be found in it. The time-temperature relation is important: in the early "holding" process milk is heated to a temperature of from 142 to 145° F. for 30 minutes. This provides a ten-minute margin of safety, as even the resistant tuberculosis organisms are killed at 140° F. in 20 minutes. The shorter process, the "hot-short method," which is gaining in popularity, heats the milk to 160° F. for 15 seconds. This includes only a short four- or five-second margin of safety, and special automatic temperature-control devices are necessary to ensure adequate heating.

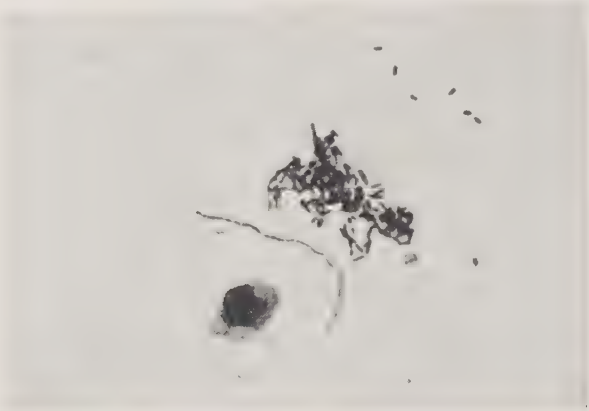

Fig. 37. One field of a microscopic slide of milk stained to show bacteria and one white corpuscle. In this method of direct examination, 1/100 cc. of milk is spread over 3,000 such areas. Estimate the total number of bacteria per cc. Could this milk qualify as certified milk?

Chemical color tests are now available to check on adequate pasteurization and also on any later addition of raw milk: even as small an amount as 0.1 per cent of raw milk will be revealed by the phosphatase color test, which is based on the fact that the phosphatase enzymes normally present in milk are killed at proper pasteurization temperatures.

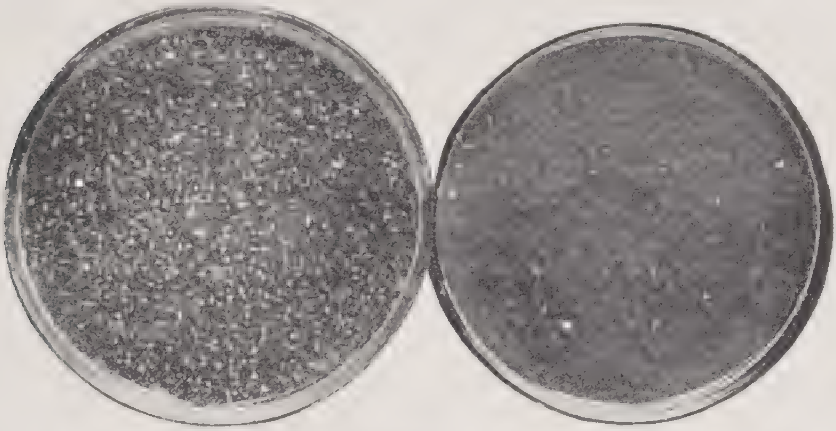

Fig. 38. The benefit of pasteurization is illustrated by the difference in these bacterial colonies developing in these two agar plates after incubation for two days at 37° C. Each contains 0.1 cc. of milk; taken before pasteurization (left plate) and from the same milk after pasteurization (right plate). (Broadhurst and Given: Microbiology Applied to Nursing, Philadelphia, Lippincott.)

Several grades of milk based on bacterial count and fat content were formerly recognized in many communities. The tendency is now towards the production of a safe, high-quality milk labeled "A," or "Approved," or "Standard," with the understanding that all milk not meeting these requirements shall be sold for cooking or manufacturing only.

Homogenized milk is milk which has been forced under high pressure through a very small aperture, breaking the fat into very fine globules so that it remains dispersed throughout the milk instead of rising as cream. Homogenization gives an even cream content to milk drawn from large containers, and it ensures the full cream value of the milk to children in the home where the cream in the bottle might be poured off for other purposes.

Vitamin D or vitamin-reinforced milk, now widely sold, is milk of high quality to which vitamin D has been added, usually by adding one of the several vitamin D concentrates.

When a surplus of human milk is available, it may be expressed and pasteurized to conserve it for malnourished infants. It is usually pasteurized in small containers, such as feeding bottles, and at a somewhat higher temperature (175° F.) than that used for cow's milk.

Certified milk was initiated in 1892 to provide a safe milk for young children, and it was first offered for sale in Montclair, New Jersey, the following year. It still represents only a small percentage of the present liquid-milk consumption—less than 2 per cent. Certified milk is produced under the supervision of an association of about 80 medical milk committees distributed throughout the country. The regulations relate to all factors that affect milk quality, including the health of the cows (freedom from tuberculosis, Bang's disease, udder infection); the health of the workers (as shown by examinations of the nose, the throat, the fecal discharges); and the milking and the handling conditions (barn ventilation and cleanliness, sterile containers, prompt cooling to 50° F. or less). Certified milk may not exceed 10,000 bacteria per cc. when delivered to a customer. Certified milk may be pasteurized, as an added assurance of safety. When pasteurized, the bacterial limit is 500 per cc. In New York State all certified milk must be pasteurized.

Filled-milk bills which would have allowed the removal of butterfat or cream and the substitution of another fat, such as coconut oil, have several times been defeated by our legislators. Vigilance against such efforts may still be necessary in local areas, but on the whole there is little evidence of adulteration of milk.

Ice cream is subject to the same types of contamination as milk. It must be handled under clean, sanitary conditions. Utensils must be carefully washed and sterilized. Ice cream which has once been frozen and allowed to melt should not be refrozen, as certain organisms which persisted through the frozen period may develop at the comparatively low temperatures of the melted ice cream. Since typhoid bacteria and other disease organisms which may sometimes be found in milk are not necessarily killed by freezing, ice cream should be made from milk surely free from disease organisms. The only way of ensuring such freedom in commercial-ice-cream processes is by using pasteurized milk (or cooking the custard or mix used for the ice cream). The butterfat content required for ice cream varies greatly in the different states. The minimum set by a number of states is 10 per cent for plain ice cream—a low standard, to be sure. Fruit and nut ice creams sometimes have as low as 8 per cent butterfat.

Cheese and butter are considered by some food experts to be safe after storage; for example, 60 days for soft cheese. However, disease organisms (streptococci, staphylococci) may still persist, and the only assurance of safety is in pasteurization of the milk used in their production.

OTHER FOODS

Cream-filled cakes and pastries have so frequently been found to be the cause of staphylococcal or other food poisoning that reheating such filled products at an oven temperature of 400° F. is required in a few areas. A few communities prohibit the sale of cream-filled pastries in warm weather unless so heated; refrigeration until they are sold is demanded in several other communities. Special examination of workers should be required to exclude typhoid carriers. Foods that are much handled and made-over foods such as meat loaf, meat pastes, chicken and crab meats for salads should be cooked thoroughly after final handling or mixing, or refrigerated at once at very cold temperatures.

Bakery and confectionery goods should be protected from handling by patrons and from contamination of insects. The wax-paper and cellophane coverings now used on bread, cakes, etc., are valuable sanitary aids; but housewives too frequently fail to recognize that the outer surfaces of such coverings are not clean and should not come into contact with the cutting board or foods. Bakeries have widely adopted the use of wax-paper squares for picking up rolls, cakes, etc., but almost universally the clerks thrust such soiled papers down among the rolls or cakes they are meant to protect. Tongs for picking up buns, candies, etc., are frequently mishandled; for example, the handle end is left resting on the food.

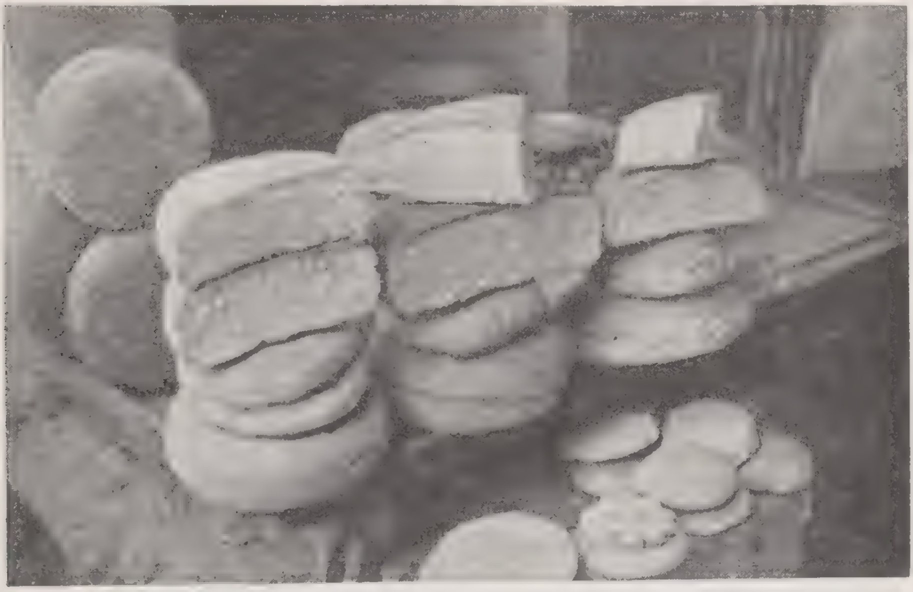

Fig. 39. This bread offered for sale in Tunisia, North Africa, is in great contrast to our present paper-wrapped loaves of bread. Notice the cut pieces that are left unprotected so that the customer may feel them to determine their freshness.

Fish and shellfish may be frozen with little or no loss in food quality. Epidemics of typhoid fever have been traced to oysters grown in sewage-contaminated water, and it is reassuring to learn that the coastal states are now co-operating with the federal government in the inspection and the control of oyster beds. At least one state now requires notification by oyster companies before they begin taking oysters from its waters, as well as the treatment of oysters with suitable chlorine solutions. Eating oysters in the "R" months means better flavored oysters, but it is not a guarantee of safety, and oysters should be cooked unless their source meets the requirements of the state board of health. Shucked oysters kept in store tanks are subject to contamination by handling. Canned oysters are always safe. Clams are less frequently implicated in disease transmission than oysters. On the Pacific coast mussels and clams have caused severe paralytic poisoning. The poison, recently shown to be due to a salt-water protozoan, is resistant to heat (cooking). Health authorities advise that the viscera (dark meat) and the juices of clams and mussels should not be eaten from May first through October.

Poultry, under former cold-storage conditions, changed in flavor due to the action of the bacteria in the alimentary canal. In the present frosted or quick-freezing process the internal organs are taken out and any material oozing from the broken alimentary canal is removed by thoroughly washing the carcass with water under pressure. The dressed poultry is then pressed into shape, protected by a woven or other covering, and quickly frozen at low temperatures.

FOOD HANDLING

As implied in the preceding pages, sanitary methods are important in every stage of food production, transportation and storage, as well as in the final handling in homes and in institutions. Contamination of foods and containers by individuals or prowling vermin should never be countenanced on the ground that later pasteurization, cooking or freezing will take care of the situation, for it has been shown experimentally that there is a limit to what such preservation methods can do; the greater the number of bacteria or molds, the less complete their destruction. The quality of the water used in preparing foods is, of course, a most important factor in food quality.

Persons at communicable stages of infectious diseases should not handle foods to be eaten by others. The complete and the frequent examinations required of individuals in connection with certified milk are too expensive and too technical to be required for all food handlers or to be conducted by all communities. Yearly or other periodic examinations would not eliminate handlers temporarily suffering from the common cold, sore throat or early and unsuspected stages of diphtheria and tuberculosis. Several of our largest cities find it more practical to license the establishments serving or supplying foods rather than the individual workers, especially as occasional emergency or volunteer workers may be more dangerous than the regular employees. Inspection of food establishments is the only control method used in some localities. Newark, New Jersey, still maintains a periodic examination-license system of food handlers, extending it even to domestic employees. Detroit registers food handlers, assembling them in groups for instruction on sanitary methods of handling foods. Other cities emphasize the control of discovered carriers or transmitters of disease through such general regulations as "no person with a communicable disease shall serve or handle food in places where food is prepared or served." This permits of action against individuals later found responsible for such transfer of disease. Individuals with active cases of pulmonary tuberculosis should be excluded from food service. Persons found to be carriers of typhoid fever, diphtheria and dysentery organisms should be listed by the city or state and warned against handling foods. The typhoid carrier condition may persist for many years —more than 40 years in two dairy workers responsible for large typhoid-fever epidemics some years ago in New York City and in Washington. Probably the longest carrier record for typhoid fever was revealed recently when an aged woman who had earlier been warned of her carrier condition transmitted typhoid fever to a great-grandchild 80 years after her attack of typhoid fever. Lack of co-operation by carriers is illustrated by the oft-repeated history of Typhoid Mary who, after causing 26 cases of typhoid fever, broke her promise not to cook for others and caused at least 25 more cases in hospitals and in other places.

Constant, close supervision of all phases of food handling is necessary. Every available standard of food quality should be utilized: appearance, legal labels or inspection stamps, and regulations concerning age, storage, shipping conditions and handling. Equipment should be properly used or managed. Ignorant or careless people may neutralize the benefits expected of wholly adequate apparatus, as was found a few years ago when several members of a medical staff contracted brucellosis through the careless manipulation of a pasteurizing apparatus.

The best steam cookers or the most expensive refrigerators will fail to do what is expected of them if they are packed too solidly with food or if the time interval is too short for the heat or the cold to penetrate the whole mass. A staphylococcal food poisoning epidemic of 231 cases in a hospital was traced to boned chicken used in salad. The numerous small pieces of chicken removed from the bones offered much surface for contact with the fingers of the workers, and when the chicken was later placed in the refrigerator the mass in the eight- and ten-gallon cans was too great to secure adequate chilling of the chicken and prevent multiplication of staphylococci from the hands of the workers.

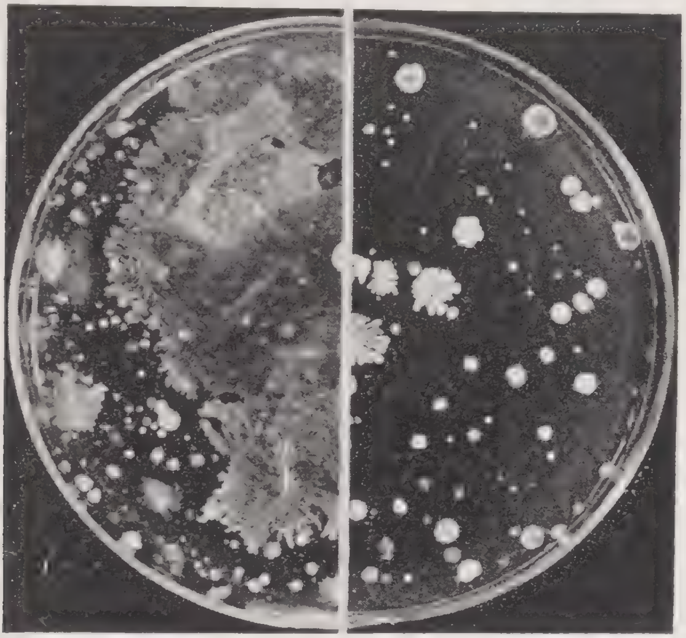

FIG. 40. Parts of two agar plates containing 1 cc. of the water used as the first wash water of two different heads of lettuce. The leaves after this washing would retain numerous bacteria, and further removal of bacteria by repeated washings is desirable.

Hand-washing facilities, including soap and warm water, should be conveniently placed, and they should be used whenever needed to lessen the chance of the transfer of respiratory and intestinal organisms to food and silverware. The frequent outbreaks of food disturbances due to streptococci, staphylococci and intestinal salmonella bacteria indicate a lack of such preventive procedures. The possibility of disease transfer by volunteer helpers—for example, ambulatory patients in hospital wards—is too often ignored, especially since most wards are inadequately supplied with facilities for hand-washing.

Gross or crude habits or manners may result in contamination of foods beautifully cooked and attractive in appearance; or, what is almost as important with the fickle appetite of ill persons, take away the appetite completely and even cause nausea. Such practices as licking the fingers or using a talon fingernail to open the individual milk bottles served a patron need only be mentioned to show them in their true light. From the point of hygiene, food service may be as important as food selection. In both, the watchword must be eternal vigilance.

Fruits and vegetables that are ordinarily eaten uncooked should not be displayed on the street or in open spaces where street dust may have access to them. Careful washing (Fig. 40) at home does much to remove such dirt and micro-organisms, but unnecessary exposure is unwarranted. However, many municipalities permit such display but require that the containers be placed at least 2 feet above the street in order to lessen contact with animals or contamination with dust from the sidewalk, which is after all an inadequate measure. All fruits should be washed thoroughly before cooking and before being eaten as raw foods to remove any chemicals used to control plant diseases and insect pests. It is unfortunate that only the banana among fruits has a protective outer covering which may be readily removed without finger contact with the inner fruit.

LEGISLATIVE CONTROL

The need for legislative control of foods is shown by the fact that more and more food is now being prepared and served outside the home.

Federal Legislation

The Federal Food, Drug and Cosmetic Act of 1938 preserves the worthy features of the 1906 Act, but extends its regulations to cover cosmetics as well as drugs and all articles used for food and drink.

Every purchaser of food has a right to know that the food he purchases is what it purports to be; that it is in a good state of preservation; that it does not contain disease-producing substances; and that it has lost none of the original food value ordinarily retained by accepted methods of food preservation.

To ensure these points the Federal Government passed two federal food laws in 1906: a Meat Inspection Act, which is still in force, with various later emendations and additions; and a "pure food law," or a Food and Drugs Act, which has been replaced by the 1938 Federal Food, Drug and Cosmetic Act. The regulations in these acts apply to all imported foods, as well as to those produced within the country, where, strictly speaking, they apply only to foods for interstate trade. However, many large food companies find it simpler to treat food to be sold within the state in the same way as foods designed for interstate sale. Recent rulings state that extensive advertising in widely circulated literature may be considered *prima facie* evidence that the advertised foods are intended for interstate commerce.

In these federal acts the penalties

for violation vary from confiscation of an adulterated or misbranded food to fines up to $1,000 and imprisonment up to one year; heavier penalties (three years, $10,000) may be levied for subsequent offenses or actual intent to defraud. In lesser offenses, the producer may be allowed to relabel the product in question.

A new and important phase of this food-control act lies in the power of the Secretary of Agriculture to establish standards for products and containers. These standards are issued from time to time and range from the per cent of sugar in canned peaches to the maturity of peas and melons and the effects of freezing in specified products. Limitations are put upon the use of dyes and colorings in foods, and lists of certified coal-tar colorings are available. As they accumulate, the Federal judgments against articles of foods and drink are published in pamphlet form and are available to all interested.

The principal conditions that cause food to be considered adulterated or misbranded are as follows:

Adulterated, if:

It carries any substance that is poisonous or deleterious to health in the amounts naturally present.
It carries any such substance that has been added (in excess of authorized allowances).
It consists in whole or in part of any filthy, putrid or deleterious substance, or otherwise is unfit for food.
It has been produced and handled under insanitary conditions, and so has become contaminated with filth or rendered injurious to health.
It is the product of a diseased animal.
Its container carries any substance injurious to health.
A valuable constituent is absent.
Any substance has been substituted for it.
Damage or inferiority is concealed.
Any substance has been added to make it appear better than it is.
It contains other than certified coal-tar colors, except for citrus fruit colored according to common practice by colors not acted on by the Secretary.
Confectionery carries any alcohol in excess of 1 per cent solely from flavoring extracts, and any nonnutritive substance except harmless colors, flavors, glaze and masticatory substances in chewing gum.

Misbranded, if:

Its label is false or misleading in any particular.
It is offered for sale under the name of another food.
It is an imitation of another food, unless so declared.
The container is so made, formed or filled as to be misleading.
The label does not bear:
  The name and the address of the manufacturer, the packer or the distributor.
  An accurate statement of weight, measure or numerical count of contents.
Any of the required information is inconspicuous or obscure.
It does not conform to the standard of quality or fill of container required by the regulations, unless the label states that the food is below such standard.
It purports to be for special dietary uses without carrying on its label full information of its vitamin, mineral and other dietary properties.
Its content of added artificial colors, flavors or chemical preservatives is not declared on the label (except butter, cheese or ice cream).

The Meat Inspection Act provides for the examination of all animals intended for slaughter, provision being made that all animals found unfit for food shall be rejected, killed and their carcasses destroyed. It also provides for a postmortem examination by a federal inspector of the carcasses of animals slaughtered in all packing houses doing interstate or foreign business, and all meat products manufactured from such meats (sausages, lard, etc.). If these carcasses pass this examination they are stamped "U. S. Inspected and Passed." If condemned, they are designated as "U. S. Inspected and Condemned." Condemned carcasses must be destroyed under the direction of the federal inspector. Certain animals which are not considered

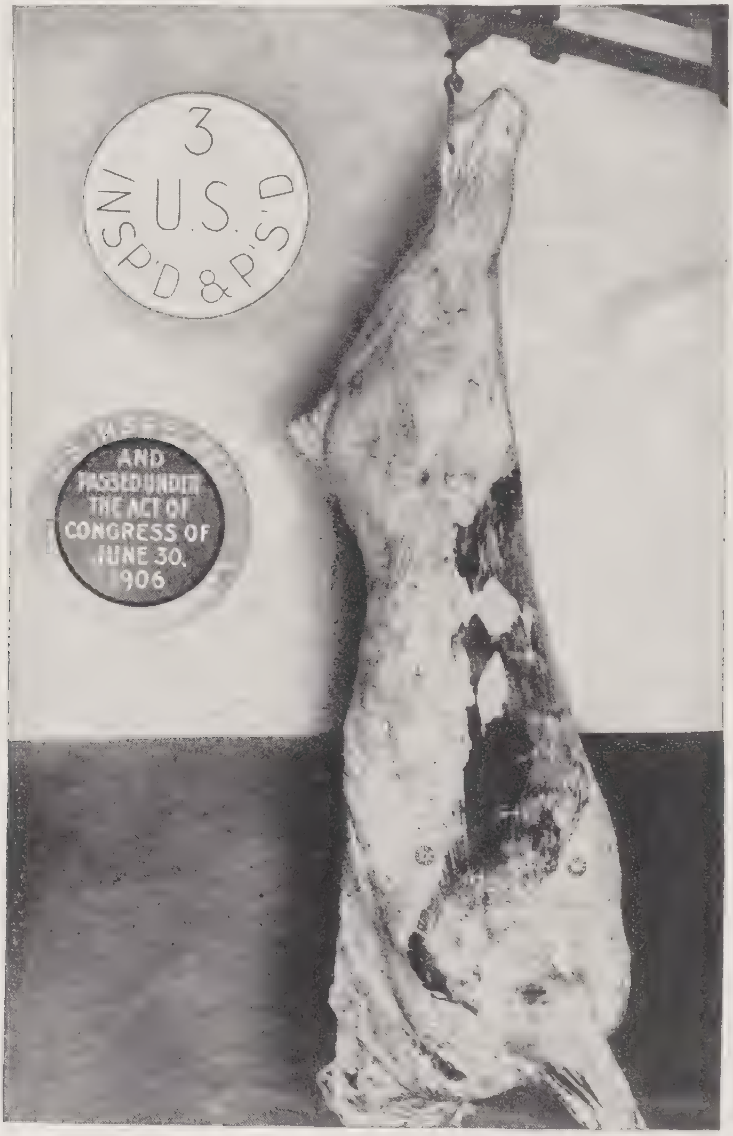

Fig. 41. Beef carcass showing Government inspection stamps. (Swift and Company.)

safe for ordinary consumption may be marked "Passed for Sterilization," in which case they may be rendered and the fat used, or certain parts may be salvaged, under direction of the inspector, especially if such parts are cooked, as in canned meats. The temperatures used in sterilization must be sufficiently high (240° F.) to kill all dangerous micro-organisms. Meat and meat products brought into the United States are, of course, subject to the same standards as domestic products.

State and Community Legislation

Practically all states have passed food rulings fashioned more or less after the federal regulations, though they tend to be less rigorous. Some states have much more adequate control than others. Unfortunately, appropriations for enforcing these laws are often lacking and only flagrant violations may be given attention. Cities and towns may also frame local food regulations, providing they do not conflict with state or federal laws. A local board of health can enforce more stringent rulings but cannot lower the sanitary requirements of state and federal legislation.

All public-health workers should inform themselves regarding the foods laws of their state and city. Many cities and most states publish health codes for distribution to all concerned in handling milk and other foods. If proper laws do not exist, an effort should be made to secure such legislation. Frequently there are laws on the statute books that should protect the people, but public officials, like other human beings, are often prone to forget things about which there is little or no agitation. Public opinion, therefore, as expressed by investigations made by clubs or groups of public-spirited citizens, is the best means of ensuring, locally, a safe food supply.

SUMMARY

1. Food-borne illness may be caused by poisons peculiar to certain foods, by the presence of foreign chemicals, and by bacteria and other disease-producing organisms.
2. Viruses and bacteria should not be used as poisons to control vermin.
3. Diseases of the upper respiratory area and the intestinal tract are readily transmitted through food by careless food handlers.
4. Very low temperatures used in cold storage kill trichinella and other worms sometimes present in meat (swine and cattle).
5. Cold storage of foods inhibits but does not destroy all bacteria and fungi.
6. Cold, as a preservative of foods, is often reinforced by chemical action, such as ultraviolet light.
7. Adequate heating in canning foods is necessary to protect against botulism.
8. Pasteurization destroys disease organisms that may occur in milk.
9. The present tendency is toward one grade of safe, pasteurized milk for general consumption, with milk falling below such standards sold only for cooking or food manufacture.
10. Oyster-borne typhoid fever is controlled by inspection of the oyster beds and by chlorination.
11. Persons known to be "carriers" should not handle food to be eaten by others.
12. Intelligent co-operation by all food handlers is necessary to prevent the transfer of disease.
13. Legislative control of the pro-

duction of meat and other foods is necessary to protect health.

REVIEW QUESTIONS

1. What chemicals or preservatives are allowed in food production? What substances should be limited or prohibited?
2. What diseases may be transmitted to man through animal foods? What human diseases are readily transmitted through food?
3. List in order of importance the food-borne diseases reported for 1945 by the U. S. Public Health Service.
4. Distinguish between cool and cold storage.
5. Why should frozen foods be cooked while still frozen or immediately on thawing?
6. What are the requirements for pasteurizing milk?
7. Why do many persons feel that foods that have probably had contact with the soil should be canned at high temperatures (under pressure) and, if home-canned, reheated before use?
8. What is certified milk?
9. How may the dangers of food poisoning by cream-filled pastries be decreased?
10. What protection is assured by the Meat Inspection Act? By the Food, Drug and Cosmetic Act?
11. Why are state and community regulations also necessary to protect health?

15

Nutrition During Pregnancy and Lactation

Chapter Topics

FOOD DEMANDS OF PREGNANCY
  AMOUNT OF FOOD
  PROTEIN REQUIREMENT
  MINERAL REQUIREMENT
  VITAMIN REQUIREMENT
FOOD SELECTION DURING PREGNANCY
FOOD UTILIZATION DURING PREGNANCY
FOOD DURING LABOR AND THE PUERPERAL STATE
DIET DURING LACTATION

"Concern for the child must antedate conception and extend to the final phases of growth and adolescence. Care of the unborn child is provided by adequate supervision of the pregnant woman," states Mitchell[1] in his "Textbook of Pediatrics." The obstetrician who has the responsibility of this supervision recognizes today the part which proper diet plays in the welfare of both mother and child. An adequate diet not only does its part in furnishing the material which the growing fetus needs for normal development but protects the mother against a deficiency. Also, it is now believed that it helps to alleviate the discomfort of nausea in the first stages of pregnancy and may even help to prevent the more serious complications of the latter part of pregnancy.

FOOD DEMANDS OF PREGNANCY

Pregnancy makes many demands upon the maternal organism. As would be expected during the period when the body of the unborn infant is being built, the food of the prospective mother needs special consideration. Even the normal healthy woman who has been taking an adequate diet will require more dietary essentials. Research work in nutrition, conducted first of all upon laboratory animals, has shown that diet affects the stature and the physical characteristics of succeeding generations. A deficiency of any essential dietary factor produces symptoms in the offspring which in many cases can be traced to such deficiency. The work with laboratory animals caused a change in the attitude toward the effect of diet upon the development of the fetus and the health of the human infant, as well as upon the condition of the prospective mother. Formerly it had been assumed that except in cases of acute deficiencies of food in general, the infant would not be affected materially. In recent years, studies of nutrition of women during pregnancy, conducted both in this country and in Britain, have shown that there is a definite relationship between the diet of the mother and the condition of the infant at birth. They have also shown that toxemia and anemia can be largely prevented by a diet adequate for both mother and child.

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[1] Mitchell and Nelson: Textbook of Pediatrics, ed. 4, Philadelphia, Saunders, 1945.

Amount of Food. While metabolism rises during pregnancy, it is not necessary to increase the quantity of the food for a woman of normal weight during the first trimester. In cases of underweight, often the sign of undernourishment, the amount of food may have to be increased in the interest of normal nutrition, upon which the health of both mother and child will largely depend. The weight gain of the fetus is small in the first period of pregnancy. According to Zabriskie and Eastman:[2] "At first the average gain in weight of the fetus is 1 Gm. daily; nine tenths of the weight is gained after the fifth month, and one half of the weight of the fetus is acquired during the last 8 weeks. It is to be expected that most pregnant women have an average gain in weight of between 20 and 25 pounds during pregnancy."

It is unwise for a pregnant woman to add weight out of proportion to the gain of the new tissue formation in the fetus. The average weight gain should be about 2 pounds a month. The cause of any plus or minus to this amount of gain should be determined and the proper measures taken. In cases of overweight, it may be necessary actually to decrease the quantity of food taken normally. Reduction in food high in carbohydrate and fat will then be indicated. The diet must continue to be adequate in foods which supply protein, minerals and vitamins. According to the standards of the Food and Nutrition Board of the National Research Council, the caloric allowance should be increased during the latter part of pregnancy to approximately 20 per cent over the normal level. The requirement will be from 2,100 calories per day for a sedentary woman to 2,500 calories for the pregnant woman (see Chap. 6).

The craving for special foods which some women experience during pregnancy may be satisfied if this is not at the expense of other more essential foods. There is an exception in the case of highly salted products. It is also advised that foods which are common causes of allergy be used sparingly, as these may predispose the infant to sensitivity. In certain cases, as in hypertension, the physician may recommend a definite reduction in the use of salt or its discontinuance.

Some authorities believe that a well-chosen diet with a proper caloric content will meet all dietary needs for the pregnant woman. C. J. Lund[3] states that the daily regimen of food should be the same as that generally accepted for the usual optimum diet, except for an increase in the amount of milk usually taken: "For optimal supply the daily diet should consist of one generous serving of meat (including liver weekly), a quart of milk, an ounce of butter, one fresh vegetable, one green leafy vegetable and one other cooked vegetable, generous amounts of citrus fruits or their equivalent, an egg, and whole-grain or enriched bread." He believes that supplements are seldom necessary, except perhaps in the case of vitamin A. Recommendations by other authorities for supplements will be discussed under specific headings.

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[2] Zabriskie and Eastman: Nurses Handbook of Obstetrics, Philadelphia, Lippincott, 1945.

[3] Lund, C. J.: J.A.M A. 128:344, 1945.

Protein Requirement. Protein must be adequate because of its specific contributions and because a diet low in it is as a rule lacking in other factors. The protein in the diet of many pregnant women falls below that recommended in ordinary conditions. Burke and associates,[4] in a report on a study of 216 pregnant women, say: ". . . only 10 per cent consumed diets which met the standard for protein recommended by the National Research Council; 68 per cent of the diets contained less than 70 Gm. protein daily and 38 per cent less than 55 Gm., while 14 per cent contained under 45 Gm. protein daily during this important period of rapid fetal development. A very significant relationship was found between the protein content of the mother's diet during pregnancy and the length of her infant at birth. For practical purposes this study indicates that less than 75 Gm. protein daily during the latter part of pregnancy results in an infant who will tend to be short, light in weight, and most likely receive a low pediatric rating in other respects. Here again in a human study it is impossible to prove that protein alone is the significant nutrient; it may well be that certain of the B vitamins—for example, associated in the foods with protein—are factors in this relationship."

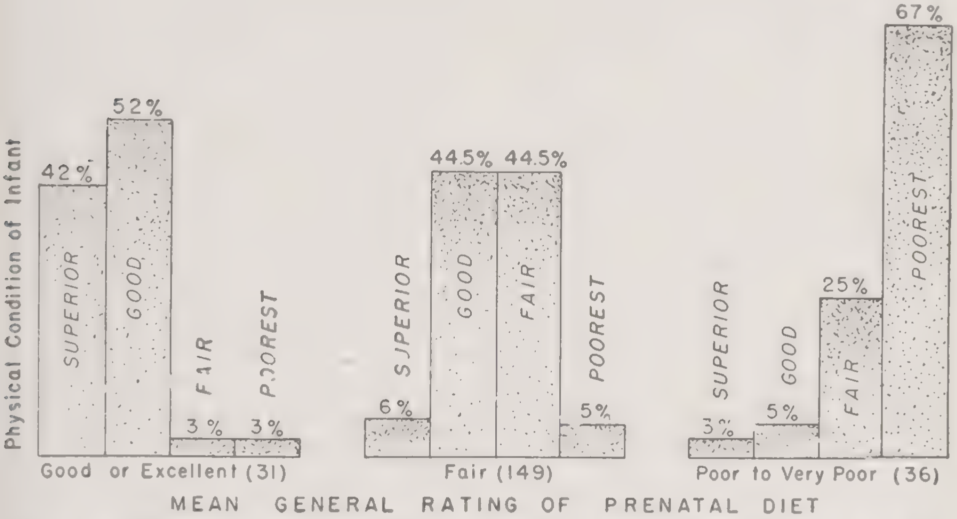

Fig. 42. Prenatal diet affects the physical condition of the infant. (Burke, B. S., *et al.*: J. Nutrition **26**:569, 1943.)

A recent study by Leverton [5] reports the results of the addition of a 5-oz. serving of lean meat to the regular diet. This supplement induced improvement in the hemoglobin and the red-cell content of the blood, and women were able to nurse their babies for a longer period. These results are contrary to the earlier belief that meat should be reduced during pregnancy. As meat is an expensive food, an amount larger than usual will probably not be given especial prominence in recommended diets during pregnancy. Extra protein if desirable may be supplied inexpensively by the use of dried skim milk in generous proportions to creamed soups and other dishes which demand milk as an ingredient. Soybean flour used in combination with other flours will also furnish extra protein inexpensively. It should be noted that an adequate caloric intake from a mixed diet is recognized as protein-sparing. P. F. Williams[6] sums up the protein requirement as follows:

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[4] Burke, Bertha S.: J. Am. Dietet. A. **20**:735, 1944.

[5] Leverton, Ruth M.: J.A.M.A. **130**:134, 1946.

"It is an incontestable fact that a pregnant woman differs from other persons in her protein needs. To the basic need of the nonpregnant woman for material building and repair there are added during pregnancy the demands of an increased metabolism, the storage of nitrogen, the growth of the woman's body, the necessity for meeting needs of fetal growth and repair, the growth of the mammary tissue and the hormonal preparation for lactation. Under ordinary circumstances a desirable allowance of protein is considered to be 1 Gm. per kilogram body weight in an adult, but nutritional authorities agree that an increase to 1.5 Gm. per kilogram is safer to supply the demands of fetal and maternal growth and tissue repair in the latter half of pregnancy."

Calcium and Phosphorus Requirement. The pregnant woman must be supplied with calcium and phosphorus in quantities large enough for her own needs and those of the bony framework of the body of the growing fetus and for the formation of teeth. Both mother and child need these minerals also for other body functions, as discussed in Chapter 7. The proper utilization of calcium and phosphorus depends upon the inclusion of a certain amount of vitamin D (see Chap. 8, Vitamins). The allowance of a quart of milk a day will supply a large proportion of the calcium and phosphorus, making the total adequate if the diet includes the prescribed amount of vegetables and fruits. Studies carried on by a number of research workers indicate that a prenatal diet high in calcium and phosphorus affects not only the calcification of the teeth in the first year but possibly the incidence of caries in the following years.

Iron Requirement. An adequate iron supply during pregnancy is no less important than that of calcium; in fact, it may be more important because the anemia of pregnancy is common, whereas the greater drain upon the mother's calcium store probably comes during lactation. There is a prenatal storage of iron in the fetus for use during the first months of life, while the major demand for calcium comes after birth during the nursing period. Foods rich in iron, including liver, eggs, molasses and green vegetables, are recommended for the pregnant mother. On the advice of the physician, these may be supplemented by an iron preparation taken orally or by a liver extract given by injection. Clinical studies show that hemoglobin levels tend to be lower in women of low-income level. This finding may result from limited proteins and vitamins, as well as iron, in the diet. Dillon[7] believes that anemia during pregnancy may be responsible for minor ailments and ill-health in the case of both mother and child. When the iron content of the normal diet has been inadequate, there is danger of anemia and some physicians believe that some form of iron, in addition to food rich in iron, should be given after the first three months of pregnancy.

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[6] Williams, P. F.: J.A.M.A. **127**:1052, 1945.

[7] Dillon, R. A.: The Anemias of Pregnancy, New England J. Med. **229**: 718, 1943.

Iodine Requirement. Iodine is also an important element in the diet of the pregnant woman. A deficiency of this element during pregnancy may cause goiter in the child or in the mother. The use of iodized salt and of sea foods is suggested for those who live in areas in which the soil and the drinking water are known to be deficient in iodine.

Vitamin Requirement. An adequate supply of vitamins is of course essential during the period of pregnancy. The increase above the normal allowances which is necessary is not clearly defined, although studies are being conducted on this. Lund[8] states that "much exaggeration has come from those exploiting vitamins." As noted previously, he believes that most vitamin requirements can be fulfilled by food without the addition of vitamins.

In the case of vitamin A, Lund,[9] however, as well as other authorities, advised the use of concentrates during the second and the third trimesters. During this period, tests show a decrease in the plasma vitamin A in the mother, which may be caused by its storage in the liver of the fetus. With regard to the vitamins of the B complex, it is naturally essential that there should be a slight increase, which will be supplied by a diet adequate to the rising needs of pregnancy. The addition of thiamine in concentrate form has been found to be an advantage by some authorities. Lockhart[10] believes that the need for thiamine is tripled during the latter part of pregnancy. Ebbs[11] has found that doubling or trebling the usual thiamine allowance has resulted in distinct improvement in both the physical and the mental status of the patient. In certain cases, nausea in early pregnancy has been relieved by the administration of thiamine, especially when the general diet has been inadequate before pregnancy. Stander[12] states that a diet adequate in vitamin B may also prevent polyneuritis, which may occur at this time.

Authorities differ with regard to the need for extra vitamin C. It is agreed that the ascorbic acid requirement is increased during the latter months. As citrus-fruit juices and tomato juice are usually well taken, the inclusion of a liberal amount in the diet is a wise precaution. When for some reason they are not taken in sufficient quantities, ascorbic acid tablets will be a good and inexpensive source. While the exact requirement of vitamin D during pregnancy is not known, it is of course essential for the utilization of calcium and phosphorus. Burke[13] advises that "until more exact knowledge is available, it would seem wise to follow the allowance of 400 to 800 I.U. daily recommended by the National Research Council." This may be taken through fortified milk or in the form of a concentrate. Another vitamin that has a function in pregnancy is vitamin K, which the physician is finding beneficial for administration a short time before delivery in order to prevent hemorrhagic disease. Mineral oil in any form interferes with the absorption of the fat-soluble vitamins and should be avoided, especially during pregnancy (see Chap. 8).

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[8] *Op. cit.*

[9] *Ibid.*

[10] Lockhart, H. S.: Am. J. Obst. & Gynec. 46:358, 1943.

[11] Ebbs, J. H.: Canad. M.A.J. 46:6, 1942.

[12] Stander, H. J.: Textbook of Obstetrics ed. 9, New York, Appleton, 1945.

[13] *Op. cit.*

FOOD SELECTION DURING PREGNANCY

The principles of food selection for an adequate diet during pregnancy and for normal needs are the same. Care should be taken that all foods included in the Basic Seven chart (see Chap. 2) should be included daily and generously. Milk is the one food which usually has to be increased greatly. When a woman has been in the habit of drinking milk as such, it is not difficult to incorporate the recommended quart of milk a day in the diet. The foods listed by Lund (p. 172) should be supplemented by breakfast cereals, by simple desserts and other foods which have appetite appeal, always with reference to the maintenance of normal weight. While modification of diet may be necessary at the various stages of pregnancy, the following plan for a day's menu can be followed with variations through most of the period:

A Day's Meal Plan for the Healthy Pregnant Woman of Average Weight [14]

BREAKFAST

Fruit: Grapefruit, orange or other fruit rich in vitamin C.

Cereal: Whole-grain or restored.

Bread: Whole-grain or enriched bread with butter or with margarine that contains added vitamin A.

Milk: A glass of milk or a cup of cocoa made with milk. Coffee may be taken, if desired, but it should not replace the milk.

DINNER

Meat: A liberal serving of lean meat.

Vegetables:

A potato, white or sweet.

A cooked vegetable, usually a green leafy vegetable or a deep-yellow one.

A raw vegetable; this may be served as a salad.

Bread: Whole-grain or enriched bread with butter or with margarine that contains added vitamin A.

Dessert: Desserts made with milk or fruit should be served often.

Milk: A glass of milk.

SUPPER OR LUNCHEON

Main dish: A dish made with eggs, with cheese or with milk, such as an omelet or rice and cheese.

Vegetable: A cooked vegetable or a salad, depending upon the choice made at other meals.

Dessert: Raw or cooked fruit, with plain cake or cookies.

Milk: A glass of milk.

Cod-liver oil or some other source of vitamin D as directed by the doctor.

FOOD UTILIZATION DURING PREGNANCY

The digestive problems of pregnancy have been found in most cases to have some relation to the adequacy of the diet before pregnancy. During the first trimester there may be trouble with nausea. There may also be lack of appetite during the day. Certain foods which have been taken without trouble previously may cause disturbance. Fats are a common cause of upset, although butter and cream are usually well taken. However, if they are not, milk may be taken in skim form, as most of the dietary essentials remain after the cream has been removed. Sometimes it is better to take a number of small meals a day rather than three regular meals. Foods high in carbohydrate and vitamins B and C should be stressed. Hard breads such as dry toast and crackers are usually well taken. During this period the growth of the fetus is slow and it is not necessary to increase the total food intake above normal, even when there are no digestive complications. Pernicious vomiting, if it occurs, must be treated by the physician.

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[14] U. S. Department of Labor, Children's Bureau: Prenatal Care, Publication No. 4, p. 10.

After the first three months, when digestive troubles if they have been present are usually over, the food intake may be increased in line with normal increase in weight. If for any reason a quart of milk cannot be included each day, there should be an increase in protein-bearing foods such as meat, fish, eggs and cheese. As has been mentioned previously, liver should be served preferably once a week. Vegetables in green, frozen or canned form, as well as salad greens, should be used freely, as indicated in the day's meal plan. It should be noted that this calls for the inclusion of fruit twice a day, once in the form of citrus fruit or tomato juice and again in raw or cooked form. Canned fruits are considered to be cooked fruits. During the latter part of the second trimester the pressure of the enlarging uterus may cause intestinal stasis. This may be prevented by use of a laxative diet. Such laxative foods as the following are better than too many drugs: Figs, prunes, fresh fruits, fruit juices, fresh vegetables and, in some cases, bran. A liberal amount of water and other fluids should be taken throughout pregnancy, as they aid in the elimination of waste products and thus may prevent digestive and kidney disturbances.

During the third trimester, metabolism continues to increase with the weight increases in both the mother and the fetus. There may be a tendency toward obesity in the mother at this period, however, and in this event food should be limited to absolute fuel requirement without curtailing protein, mineral or vitamin intake. In some conditions it may be necessary to eliminate salt from the diet. McLester[15] states that if the woman is of normal weight at the beginning of pregnancy, she should be permitted to gain about fifteen pounds to allow for the growth of the fetus and the placenta; but if underweight she should be encouraged to add still more. The reduction of foods rich in calcium in an effort to produce soft bones in the child and make birth easier is a dangerous procedure and does not accomplish its purpose; instead, it depletes the calcium content of the mother's bones. Restriction of calcium in the diet will not result in a small baby.

During this period the so-called toxemias of pregnancy, the exact causes of which are still undetermined, are likely to make their appearance. The symptoms to be noted are (1) elevation of blood pressure, (2) albuminuria, (3) edema, (4) convulsions and (5) coma. Many authorities on the subject believe that in the large majority of cases these symptoms are due to vasculorenal disease which existed before pregnancy occurred. Nevertheless, some are due to pregnancy and are therefore said to be "true toxemia" of pregnancy. Recent findings seem to show that toxemia is uncommon when diet has been adequate throughout pregnancy. A report by Burke[16] in the study previously mentioned shows that no woman whose diet was rated good or excellent suffered from toxemia. In a study of the effect of mineral and vitamin supplements conducted by the

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[15] McLester, James S.: Nutrition and Diet in Health and Disease, Philadelphia, Saunders, 1943.

[16] *Op. cit.*

People's League of England, it is reported that toxemia was largely reduced by these additions.

FOOD DURING LABOR AND THE PUERPERAL STATE

During the first stages of labor there need be no variation from the usual diet if the patient can take foods without digestive disturbance. Otherwise, a liquid diet high in food value should be given in order to keep up strength which may be needed if labor is prolonged. During the latter period, food should be in liquid form. Strained fruit juices lightly sweetened, ginger ale, clear tea and coffee, sweetened if desired, and strained broth are usually well tolerated.

After delivery, a liquid diet is usually given for the first twenty-four hours. This may include milk beverages, ice cream, custard and gelatin desserts. After this period, there may be a return to normal diet unless there is some medical reason against it. For discussion of liquid and soft diet, refer to Chapter 19. When the mother nurses the baby, there must be an even greater allowance of food than there was during pregnancy. A reprint, "Food During Labor and Puerperal State," from the "Child," 1945, may be obtained from the U. S. Department of Labor, Children's Bureau.

DIET DURING LACTATION

Lactation makes even greater demands in some respects upon the maternal organism than pregnancy. The child after birth must still be fed from the mother's body, the food now being elaborated by the mammary glands instead of being supplied through the blood stream as before birth. As the baby gains in weight and becomes increasingly active, the food supply from the mother must increase. A healthy infant may be expected to double its weight by the fifth and the sixth months, and often reaches this figure by the fourth month. After the first week, when frequently there is a loss in weight of from 4 to 8 ounces, the gain should be from 4 to 8 ounces weekly. This rate of gain continues until approximately the sixth month. Then the gain is usually about 4 ounces per week, decreasing gradually until the end of the first year, when it averages about 2 ounces per week.

Supply of Mother's Milk. A normal infant will consume daily 2½ ounces of mother's milk for each pound of his weight. The younger the baby, the larger the intake per pound of body weight. An 8-pound infant will, therefore, consume approximately 20 ounces, while a 15-pound baby will consume about 30 ounces. Since human milk has a caloric value of twenty calories per ounce, it will be readily seen, then, that a nursing mother must supply several hundred additional calories per day as food for the infant. It has been estimated that the additional fuel requirements for the mother who is nursing a baby are as follows: [17]

	Calories per pound of infant's weight
First 3 months...........	60
Second 3 months.........	50
Third and fourth 3 months..............	40-45

Dietary Requirements. The nursing woman of sedentary habits will therefore require approximately 2,800 to 3,000 calories, while the woman doing medium or hard work will require 3,600 calories or more. Not only are the requirements for the mainte-

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[17] Rose, M. S.: Feeding the Family, New York, Macmillan, 1940.

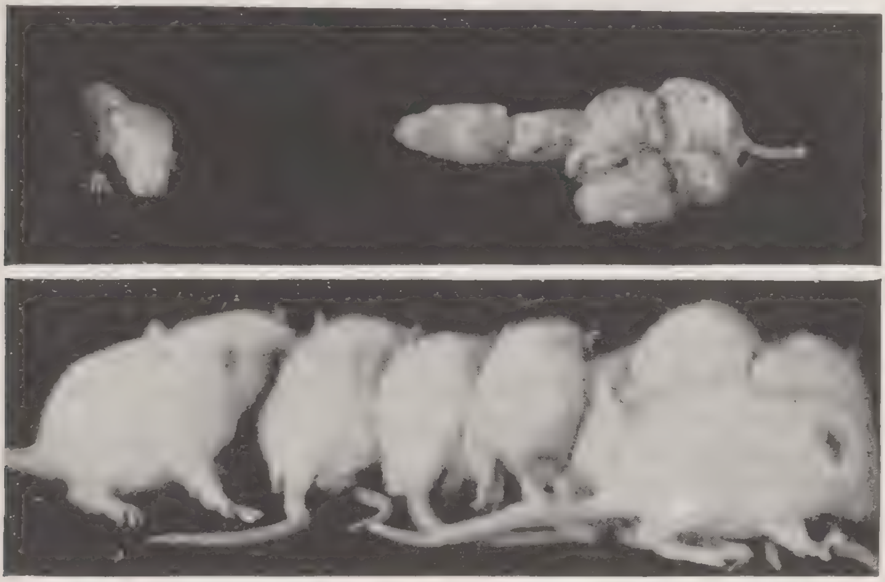

Fig. 43. (*Top*) Mother on toast and coffee. (*Bottom*) Mother on cow's milk. The diet of the human mother may markedly affect the growth and survival of the nursing young, as it did here in the case of the rats.

nance of energy increased during lactation, but there is also an increase in the requirements of proteins, minerals and vitamins. These needs may be met by the consumption of larger quantities of the same foods used during pregnancy. Milk should be increased to 1½ quarts and there should be larger servings of meat and other protein foods and additional servings of fruits and vegetables. Some source of vitamin D may be included at the direction of the physician. Fried foods and foods rich in fat should generally be avoided, as should highly seasoned foods such as sausage and pickles. Sometimes foods high in fiber must be avoided. Highly flavored vegetables and dried beans, except in soup form, may also cause disturbances.

Between-meal feedings are often advisable during lactation, and plenty of water as well as other liquids should be taken. A typical sample menu for a day follows:

Sample Meals for a Day on a Full Diet[18]

BREAKFAST

Stewed prunes
Shredded-wheat cereal with milk (sugar if desired)
Scrambled eggs
Toast with butter or fortified margarine
Milk or coffee (or both)

MIDMORNING LUNCH

Milk (if not taken at breakfast)

NOON MEAL

Tomato juice
Baked ham
Scalloped potatoes
Green beans
Raw carrot sticks
Whole-wheat bread and butter or fortified margarine

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[18] U. S. Department of Labor, Children's Bureau: The Child 9:169-171, 1945. For a year's subscription to the "Child" send $1.00 to Superintendent of Documents, Government Printing Office, Washington, D. C.

Cup custard
Milk and coffee or tea (if desired)

MIDAFTERNOON LUNCH

Orange or grapefruit juice

EVENING MEAL

Tomato and cottage cheese salad
Biscuit with butter or fortified margarine
Apple sauce
Gingerbread
Milk and coffee or tea (if desired)

Statistics on maternal and infant mortality in the United States show a significant reduction in the ten years between 1933 and 1943. Maternal mortality decreased 60 per cent and the mortality rate of infants under one year of age also dropped materially, particularly during the period of the second and the twelfth months. The highest death rate was among infants of premature birth. A further improvement in prenatal care for mothers and for premature infants will doubtless be responsible for an even better record at the end of the next ten-year period. In accomplishing this, the application of the science of nutrition will play its part.

REVIEW QUESTIONS

1. Even the normal healthy woman who has been taking an adequate diet will require more dietary essentials during pregnancy. Review Recommended Dietary Allowances of the Food and Nutrition Board of the National Research Council for women in various activities. Which allowances increase in ratio to the caloric allowance? What other essentials should be increased during pregnancy?

2. Research work in nutrition upon laboratory animals has shown that diet affects the offspring. Are there evidences that this applies to human beings?

3. It is not necessary to increase the quantity of food for a woman of normal weight during the first trimester. For what reasons might the amount of food be increased? When should it be reduced?

4. An adequate amount of protein is important in pregnancy. Discuss the results of an inadequate intake of protein. In what forms may extra protein be added to the diet?

5. The mineral requirement is naturally larger during pregnancy. How may the calcium and the phosphorus requirements be fulfilled? What are the sources of iron for an adequate supply? How may the iodine requirement be fulfilled?

6. The principles of food selection during pregnancy are the same as for an adequate diet for normal needs. Plan a menu for a day for a healthy pregnant woman of average weight. Make necessary modifications for a woman who is underweight. For one who is overweight.

7. During the first trimester there may be trouble with nausea. How may the usual menu be modified?

8. If for any reason the quota of milk cannot be taken each day, how may the protein content be made adequate? Suggest appetizing, easily digested dishes which may be used in the menu.

9. During the latter part of the second trimester, the pressure of the enlarged uterus may cause intestinal stasis. In this event what measures should be taken? Why should a liberal amount of fluid be taken throughout pregnancy?

10. During the third trimester,

toxemia may appear. Is there anything to indicate that diet may act as a preventive? If so, state the evidence.

11. Lactation makes greater demands upon the mother than does pregnancy. What food increases should be made to stimulate the supply of milk? What foods may cause digestive disturbances? Plan a menu differing in content from the sample menu on page 179 but as adequate to it in every respect.

16

Nutrition During Infancy

Chapter Topics

BREAST FEEDING	CONTENT AND PREPARATION OF THE MODERN FORMULA
FEEDING OF PREMATURE INFANTS	SUPPLEMENTARY FOODS
ARTIFICIAL FEEDING	

BREAST FEEDING

Fortunate is the infant nourished by milk from his mother's breast. When produced by a healthy mother, human milk contains every nutrient in the proper proportion and in an easily digested form. Women should be able to nurse their babies if they have had a proper diet during pregnancy, but some are unable to do so in spite of a sincere attempt. Breast feeding not only gives the baby the advantage of starting life on this natural food but it helps the mother to recover from childbirth; it seems to stimulate a quicker return to a normal condition. While an artificially fed infant may progress satisfactorily under modern pediatric practice, most pediatricians agree that breast milk during the first three months is particularly important and that there should be a good reason for weaning the baby under 6 months of age.

It is significant that while the total infant mortality rate in the United States has decreased by 85 per cent in the last 45 years, mortality at birth and during the first month has decreased less than 20 per cent. Colostrum, the first milk secreted after the birth, has a different composition from that of the milk secreted from 20 to 30 days later, and it has been suggested that artificial feeding during the first month may not be a completely successful replacement of breast milk.

That breast feeding is worth while is shown by the fact that, in general, babies fed in this fashion rate better than those who have been bottle-fed from the beginning. It is recommended that a baby be at least partly breast-fed until the seventh or the eighth month. Under modern pediatric practice, however, the majority of infants who are bottle-fed from birth will be healthy and will grow and develop properly when the mother follows carefully the directions for preparing the prescribed formula. In a few special cases, when the mother cannot furnish breast milk herself, the expressed milk of another nursing mother may be prescribed temporarily. The physician will check the source of this milk and will probably recommend that it be boiled before it is fed to the infant.

Recent studies from a psychologic standpoint seem to show that breast feeding initiates a good relationship between mother and baby and gives the baby a sense of security. Some pediatricians believe that many of the feeding problems of later childhood have a psychologic cause and might have been avoided by breast feeding. Others feel that the bottle-fed baby will suffer neither physically nor emotionally. According to Spock,[1] ". . . if, when you give him his bottle, you cuddle him in your arms, he will be nourished spiritually, much as if he were at the breast."

FIG. 44. Adequate nutrition helps to produce happiness as well as health in the growing child.

In some circumstances it may be advisable to substitute bottle feeding for breast feeding, even when the mother has a supply of milk. These are listed by the Children's Bureau[2] as "another pregnancy; any chronic illness of a weakening nature, such as cancer, chronic Bright's disease, chronic heart disease, or severe anemia; severe prolonged infectious diseases, such as typhoid fever and lung tuberculosis; diseases in which the mother may not be responsible for her actions, such as epilepsy or dementia."

Sometimes the mother's milk may decrease in quantity, and in this case it must be supplemented or complemented by cow's milk prepared according to the doctor's prescription for the formula. The supplementary feeding replaces one or more breast feedings, while the complementary feeding is given in small quantity after each nursing period.

In order to determine whether or not the child is getting a sufficient quantity of mother's milk, it is advisable to weigh the baby both before and after each feeding during a 24-hour period. The sum total of all the feedings gives the day's nourishment. If the scales are accurate and the child is weighed with the same amount of clothing on both before and after the feeding, this should give exact information regarding the quantity.

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[1] Spock, Benjamin: The Common Sense Book of Baby and Child Care, New York, Duell, Sloan & Pearce, Inc., 1946. Also printed in Pocket Book edition, Baby & Child Care.

[2] U. S. Department of Labor, Children's Bureau: Infant Care, Publication No. 8, 1945.

The baby requires from 2 to 3 ounces of breast milk per pound of body weight. For average weights consult height-weight charts (see Part Four, Table 11).

Daily Consumption of Milk. The following table shows the approximate quantity of milk consumed by an average infant under normal conditions. For convenience, the daily consumption is given in both grams and ounces. There are usually 5 to 8 feedings according to the size and the age of the infant.

	Gm.	Oz.
1st day	10	⅓
2d day	90	3
3d day	190	6⅓
4th day	310	10
5th day	350	11½
6th day	390	13
7th	470	15⅔
3d week	500	16
4th week	600	20
8th week	800	26½
12th week	900	30
24th week	1,000	33

Feeding Schedules. Most pediatricians now believe that feeding schedules should be elastic, although the aim should be a reasonably regular schedule. The so-called demand schedule of feeding the baby whenever he seems hungry has been used by some doctors recently. The newborn infant may demand to be fed 10 times in 24 hours. In about 2 weeks he may be satisfied with 6 or 7 feedings with from 3 to 5 hours between feedings. According to Spock,[3] "if more and more babies come to be fed this way, and if it works out well, it may possibly become, in the future, one of the 'regular' ways to feed babies. . . . The method works particularly well in the early weeks of breast feeding because, if the baby is getting only a small amount at each nursing, he naturally wakes and nurses often, and this is the best way to increase the quantity of milk."

When feeding at regular 4-hour intervals is advised for the young infant the schedule for the 6 feedings is usually 6 A.M., 10 A.M., 2 P.M., 6 P.M., 10 P.M. and 2 A.M. The 2-A.M. feeding can generally be omitted by the second month, and after 4 or 5 months the 10-P.M. feeding may be omitted if the baby sleeps without waking at this time. The size of the feedings will naturally be increased with the reduction in number. Occasionally in the early weeks a 3-hour schedule will be advised to meet a special situation. There is no hard-and-fast rule as to the hours of feeding or as to the intervals between feedings.

Weaning. The average breast-fed baby is weaned between the sixth and the ninth months. He has been drinking water and perhaps orange juice from the bottle, and possibly from a cup. He may have become accustomed to the bottle by the supplement to the breast feeding which was necessary. Some pediatricians recommend the supplementary feeding even when the mother has enough milk, in order to accustom the baby to bottle feeding. In past days it was considered unwise for weaning to take place during the summer months, but with the general availability of a safe milk supply and better knowledge of formula preparation, it may usually be done successfully unless the child has been unfavorably affected by extreme heat. He should not be subjected to a new schedule if for any reason there has been a disturbance in his regular routine. The small baby cannot cope with more than one transition at a time.

[3] *Op. cit.*

FEEDING OF PREMATURE INFANTS

The premature infant needs more care in every respect than does a full-term baby. The food problem is complicated by the fact that even when the mother can supply him with milk, he is usually too weak to take it easily from the breast. He needs neither food nor water for the first 12 hours, after which he will be given boiled water until the second day, when he can usually take breast milk in very small amounts. Both water and milk are usually given by a medicine dropper covered with rubber tubing.

The breast milk must be expressed at regular intervals in order to keep up the flow of milk until the time the baby is able to take it at the breast. If the mother herself cannot supply the milk, the doctor will prescribe a special formula and feeding schedule. The baby will also be given a preparation of fish-liver oil which contains both vitamin D and vitamin A, beginning at the end of the first week. He will also need some form of vitamin C, which at first will be a concentrate dissolved in water. One 25-milligram tablet a day is usually prescribed at the end of the second week. This may be increased later until he is able to take orange juice. Another addition to the diet at the end of the first month will be an iron preparation. Eventually, if the baby is not only fed properly but given all the special attention he needs during the first months, he will be able to follow the regular schedule of a full-term baby, and will gain weight steadily.

ARTIFICIAL FEEDING

When the mother, because of ill-health, inadequate diet, physical or mental strain or other causes, does not produce sufficient milk or milk of the right quality to supply all the needs of the infant, it is necessary to resort to artificial feeding, either wholly or in part.

If for these reasons or any others it becomes necessary to substitute other food, cow's milk is usually chosen because it can be modified to resemble human milk, and a safe supply is generally available.

When a baby is bottle-fed, it is important that the diet should be checked to determine whether or not it is meeting the requirements. The normal increase in weight is one indication that a diet is satisfactory, but it is not an infallible test. Deficiencies may exist, the results of which may not be manifest for several weeks or even months. It is important to know that the diet contains (1) sufficient protein of high quality; (2) mineral elements, especially calcium and phosphorus in abundance; (3) vitamins A, B complex, C and D in quantities sufficient to induce normal growth and metabolism; and (4) sufficient calories to meet energy requirements.

The protein requirement for children is much higher per kilogram or pound of body weight than that for adults, just as is the energy requirement. Human milk when normal in quantity and quality supplies the infant with about 2½ Gm. of protein per kilogram of body weight, which is a far greater amount of protein than the 1 Gm. per kilogram needed by an adult man.

However, since mother's milk furnishes protein in the proportion of 10 per cent of the total calories, it will be seen that both the protein and the energy allowances are proportionately much higher for the child than for the adult. Cow's milk furnishes protein tc

SUGGESTED DAILY FEEDING SCHEDULE FOR PREMATURE BABIES[4]

	Baby Weighing Less Than 3½ Lbs.				Baby Weighing 3½-4½ Lbs.				Baby Weighing 4½-5½ Lbs.			
	Breast Milk		Boiled Water		Breast Milk		Boiled Water		Breast Milk		Boiled Water	
	Number of Feedings	Amount at Each Feeding	Number of Times Given	Amount Each Time	Number of Feedings	Amount at Each Feeding	Number of Times Given	Amount Each Time	Number of Feedings	Amount at Each Feeding	Number of Times Given	Amount Each Time
		Teaspoonfuls *		*Teaspoonfuls* *		*Teaspoonfuls* *		*Teaspoonfuls* *		*Teaspoonfuls* *		*Teaspoonfuls* *
1st 12 hours	..	....	..	....	..	....	2	½	..	....	3	1
13th hour	..	....	..	½	..	....	..	½	..	....	..	1
16th hour	..	....	..	½	..	....	..	½-1	..	....	..	1
18th hour	..	½	..	....	..	½	..	....	..	1	..	....
20th hour	..	....	..	½	..	....	..	½-1	..	....	..	½
22d hour	..	½	..	....	..	½-1	..	....	..	1 -2	..	....
2d day	8	½-2	6	1 -1½	8	1 -3	6	1 -2	8	2 -3	6	2-3
3d day	8	1 -2½	6	1½-2	8	2 -3½	6	2 -2½	8	3 -4	6	2-4
4th day	8	1½-3	6	2 -2½	8	2½-4	6	2½-3½	8	4 -6	6	3-4
5th-7th day	8	2 -4	6	2½-3	8	3 -5	6	3½-4	8	5 -8	6	4
8th-10th day	8	3 -5	6	2 -3	8	4 -6	6	3	8	6 -9	6	3
11th-14th day	8	3½-5½	6	2 -3	8	5 -7	4	3	8	6 -9	6	3
						Ounces		*Ounces*		*Ounces*		*Ounces*
15th-17th day	8	4 -6	6	2 -3	8	1 -1¼	3	½	8	1¼-1¾	3	½
18th-21st day	8	4½-6	6	2 -3	8	1 -1½	3	½	or { 8 6	1½-1¾ 2 -2½	3 3	½ ½

Note.—The schedule is arranged so that milk is given every 3 hours—at 3, 6, 9 and 12 o'clock. Water is given midway between feedings, except at 1:30 A.M. and 4:30 A.M. It may be necessary to feed very small or weak infants every 2 hours. Increases in the feeding should be made gradually, not more than ½ teaspoonful at a feeding. For infants weighing less than 2½ pounds the increase should not be more than ¼ teaspoonful at a feeding. When the baby is taking 2½ to 2¾ ounces of breast milk per pound he is receiving as much as is usually necessary for gain in weight. Further increase in feeding is made as the baby gains weight and therefore requires more food to supply 2½ to 2¾ ounces per pound. After the baby has begun to gain satisfactorily and is taking his feedings well, the interval between feedings may be increased and more milk given at each feeding.

* This refers to the ordinary household teaspoon, which contains 5 cc.

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[4] U. S. Department of Labor, *op. cit.*

the extent of 12-15 per cent of the total calories when 1½ ounces are allowed to each pound of body weight, as indicated below. The quality of protein of cow's milk is not so good physiologically as that of human milk, hence the larger allowance.

Cow's milk is adapted to the needs of an animal that reaches maturity in a few months, while the human offspring does not reach maturity for several years. It is to be expected, therefore, that cow's milk will be richer in body-building materials. By analysis, we find that it is much richer in protein and in the mineral salts, and somewhat richer in fat. We also find it less rich in carbohydrate and milk sugar. For this reason it must be "modified" by dilution with water and some form of sugar must be added.

Goat's milk is sometimes used in infant feeding when there is an allergy to cow's milk. As will be seen by the following table of percentage composition, it must be prepared for consumption in much the same fashion as cow's milk.

	Cow's Milk	Goat's Milk	Human Milk
	per cent	per cent	per cent
Protein	3.5	3.3	1.4
Fat	3.9	4.2	3.7
Carbohydrate	4.9	4.8	7.2
Minerals	0.7	0.7	0.2
Water	87.0	87.0	87.5

Various forms of cow's milk are used in infant feeding. Fresh pasteurized, canned evaporated milk or dried milk powder may be used in the preparation of a formula. Fresh milk must be boiled in order to sterilize it and to reduce the size of the curds which otherwise would be formed in the process of digestion. Dried milk after dilution with water, according to directions on the can, must also be boiled, but this is unnecessary in the case of canned evaporated milk as it is sterile and the process of preparation at the factory reduces the size of the curd. The choice of the type of milk for infant feeding will be determined by circumstances. Sometimes a safe, dependable fresh milk supply is not available or home refrigeration is lacking. Evaporated milk is widely distributed and will keep without refrigeration until the can is opened, after which it must be kept in a cold place, as is the case with fresh milk. Dried milk will also keep without refrigeration until the can is opened, but it must be kept covered and cold afterward. As one can contains more than will be used in preparing feeding for one day, it is not always as practical to use as canned milk. Some physicians prescribe the latter for the formula, even when the supply of fresh milk is available, as it is easier to use. Vitamin D milk may be obtained in fresh, evaporated or dried form. It has been fortified and some physicians prescribe it as one of the best sources of vitamin D for infants.

In the preparation of canned and dried whole milk, the fat content is thoroughly blended with the other milk solids. When fresh whole milk is used for the formula, the physician may advise the use of the homogenized type, in which during the process of preparation the cream is thoroughly blended and distributed throughout the milk.

Special Forms of Milk. Under some conditions a pediatrician may advise the use of a lactic-acid milk prepared either by adding lactic acid or a culture to cool boiled milk. Cooling is important before the acid is added, otherwise curds too large to pass easily through the nipple may be formed. Occasionally, orange or lemon juice is used instead of lactic acid. Temporary changes from the usual formula by the addition of extra fat through the use of top milk for part of the formula or, occasionally, by the addition of a small amount of sugar may be advised in some conditions. Sometimes fat must be lowered rather than raised. Naturally all changes of this sort are made under the advice of a physician. Proprietary foods which once were commonly used in normal feeding are now prescribed only in special cases by the physician, and then usually as an addition to milk in some form used as the basis for the formula.

Milk Substitutes. Certain infants are born with a sensitivity to the proteins of milk. This may be mild enough to cause only irritability or it may be severe enough to cause violent illness and even death. Several preparations have been devised as foods to approximate human milk in carbohydrate, protein, fat, minerals and also vitamins. These contain no milk at all. Soybean preparations are most commonly used. The protein in the soybean, glycinin, can usually be taken by infants allergic to the proteins of milk. Other milk substitutes are made from almond meal.

CONTENT AND PREPARATION OF THE MODERN FORMULA

The lower infant mortality rate and the larger number of well babies are attributed to the great advances made in the last decades in methods of feeding, especially among infants who must be artificially fed. The simplification of the formula and the early supplementation of milk and other foods deserve much credit. Mitchell[5] states, however: "Perhaps the most significant improvement in artificial feeding of infants is the reduction of bacterial contamination. Sterilization of the formula at the time of preparation and the subsequent storage of it so that bacterial contamination is avoided have been major factors in reduction of morbidity and mortality of gastro-intestinal infections during the first era of life."

Content of the Formula. The older formulas, in which an attempt was made to approximate the percentage composition of mother's milk, were very intricate and difficult to follow. The modern formula, however, of simple dilution and certain additions to cow's milk is very simple and easily carried out by any mother.

To supply the needed protein, 1½ to 2 ounces of milk are allowed for each pound of body weight for each 24-hour period. It has been found that babies grow faster if given the larger amount of milk.

To the milk is added some type of easily digested carbohydrate. This may be granulated sugar (sucrose), milk sugar, corn sirup or malt sugar (dextrimaltose). Physicians differ as to the choice of carbohydrate, but sugar and corn sirup are most often used because they can be found at the grocery store and are easy to use. The amount to be added is calculated according to the total number of calories required for 24 hours. The milk used in the day's formula will supply most of the calories, the difference being made up by the addition of carbohydrate. Water will then be added for the dilution of the protein.

The energy requirements of the baby during the first 9 months are usually met on the following allowance:

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[5] Mitchell and Nelson: Textbook of Pediatrics, ed. 4, Philadelphia, Saunders, 1945.

First three months	45-55 calories per pound or 325- 715 total calories
Second three months	43-48 calories per pound or 560- 840 total calories
Third three months	41-45 calories per pound or 725-1,140 total calories

The above figures allow not only for basal or resting metabolism but for storage and growth; for involuntary activities, including digestion, respiration and circulation; and for voluntary activity of the muscles, such as kicking and other movements of the body. Underweight babies will need more calories per pound than babies of normal weight.

Weight as Dietary Indicator. The height-weight tables in Part Four will be found useful as a means of comparison in determining average normal gains and as a basis for computing nutrition requirements.

It is important that all babies should be weighed regularly at least once a week. When the child is not making a steady gain, something is radically wrong. He should gain, during the first 6 months, from 4 to 8 ounces per week, with an average gain of about 6 ounces. Many babies double their weight in 5 months. More or less variation is to be expected, however, and if, for example, the child should gain 8 ounces one week and only 4 the next week, no alarm should be felt, as such variations are likely to occur from week to week.

The amount of food for the baby will be increased gradually first by the week and then by the month throughout the period of bottle feeding. To meet special needs the doctor may need to change the formula in the first weeks, then it will probably be standardized except for an increase in quantity. The individual infant may take more or less than the average baby of the same age. The Children's Bureau [6] suggests milk mixtures for well and rapidly growing babies of different ages. (See Table on p. 190.)

The technic of the preparation of the formula for the artificially fed infant is a matter on which the young mother should be instructed carefully. The methods used will depend to some extent upon whether the milk is in fresh, canned or dried form. In every case, however, the cleanliness and the sterilization of bottles, nipples and utensils used during the making of the formula must be stressed. The care of the filled bottles for the 24-hour allowance, which is usually made up at one time, is the same, whatever type of milk is used.

A set of utensils should, if possible, be reserved especially for preparation of the formula. A large kettle with a cover and a rack will be necessary for sterilizing bottles and other necessary utensils. The utensils include a saucepan, a funnel, a measuring cup, a standard tablespoon and a teaspoon, a knife for leveling measurements and a long-handled spoon. A long-handled brush for scrubbing bottles is essential, and tongs for removing hot bottles and other pieces of equipment are convenient. Also, there must be a strainer for use with boiled fresh and dried milk, an egg beater for use with dried milk, a can opener if the formula is made with evaporated milk and a pint jar with perforated top for nipples (metal top with several large nail holes).

Bottles should be of heat-resistant glass if possible, and there should be a bottle for every feeding. Extra bottles are convenient. There should be bottle caps in the same number. More nipples than caps will be needed, as they will be used when

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[6] U. S. Department of Labor, *op. cit.*

SAMPLE MILK MIXTURES FOR WELL BABIES OF DIFFERENT AGES

Age of Baby	Weight of Baby	Formula for Milk Mixture Made with Whole Milk, Granulated Sugar * and Water	Formula for Milk Mixture Made with Evaporated Milk, Granulated Sugar * and Water	
		For 24 Hours	*For 24 Hours*	*For Single Feeding*
3 days	7 pounds	Whole milk 8 ounces Water 7 ounces Granulated sugar * 1 tablespoonful (6 feedings of 2½ ounces)	Evaporated milk 4 ounces Water 11 ounces Granulated sugar * 1 tablespoonful (6 feedings of 2½ ounces)	¾ ounce 1¾ ounces ½ teaspoonful
2 weeks	7¼ pounds	Whole milk 12 ounces Water 6 ounces Granulated sugar * 2 tablespoonfuls (6 feedings of 3 ounces)	Evaporated milk 6 ounces Water 12 ounces Granulated sugar * 2 tablespoonfuls (6 feedings of 3 ounces)	1 ounce 2 ounces 1 teaspoonful
1 month	7¾ pounds	Whole milk 14 ounces Water 6 ounces Granulated sugar * 2½ tablespoonfuls (5 feedings of 4 ounces)	Evaporated milk 7 ounces Water 13 ounces Granulated sugar * 2½ tablespoonfuls (5 feedings of 4 ounces)	1½ ounces 2½ ounces 1½ teaspoonfuls
3 months	11 pounds	Whole milk 19 ounces Water 6 ounces Granulated sugar * 3 tablespoonfuls (5 feedings of 5 ounces)	Evaporated milk 9½ ounces Water 15½ ounces Granulated sugar * 3 tablespoonfuls (5 feedings of 5 ounces)	2 ounces 3 ounces 1¾ teaspoonfuls
5 months	14 pounds	Whole milk 24 ounces Water 8½ ounces Granulated sugar * 3 tablespoonfuls (5 feedings of 6½ ounces)	Evaporated milk 12 ounces Water 20½ ounces Granulated sugar * 3 tablespoonfuls (5 feedings of 6½ ounces)	2½ ounces 4 ounces 1¾ teaspoonfuls
7 months	16½ pounds	Whole milk 28 ounces Water 4 ounces Granulated sugar * 1 tablespoonful (4 feedings of 8 ounces)	Evaporated milk 13 ounces Water 19 ounces Granulated sugar * 1 tablespoonful (4 feedings of 8 ounces)	3½ ounces 4½ ounces 1 teaspoonful
9 months	18½ pounds	Whole milk 28 to 32 ounces (4 feedings of 7 or 8 ounces)	Evaporated milk 13 to 16 ounces Water 15 to 16 ounces (4 feedings of 7 or 8 ounces)	3½ to 4 ounces 3½ to 4 ounces

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* An equal amount of corn sirup may be used instead of granulated sugar.

FOODS USED IN INFANT FEEDING

	% Composition			Calories per		Ounce Measurements tbsp.
	Prot.	Fat	Carb.	Gm.	Oz.	
Cereal and Flour Products						
Arrowroot flour	20	tr.	62	3.3	94	2
Baby Ralston	14	2	70	3.5	99	6
Banana flour	5	2	85	3.7	105	4
Barley flour	5	tr.	82	3.5	99	4
Cerevim	20	2	67	3.7	108	8
Cream of wheat	12	1	73	3.5	99	2
Farina	12	1	76	3.6	102	3
Farina, cooked and strained	1	tr.	7	.3	8	2
Gerber's cereal	16	1	71	3.6	102	12
Mead's cereal	15	3	71	3.7	108	4
Pabena	14	2	71	3.6	102	12
Pablum	15	3	70	3.7	108	12
Rice flour	7	1	79	3.5	99	4
Rolled oats	14	7	68	3.9	111	5
Rolled oats, cooked and strained	2	tr.	8	.4	11	2
Wheat flour	11	1	75	3.5	99	4
Cream						
Cream, light 20%	3	20	4	2.1	59	2
Milk, Liquid						
Acidophilus	4	tr.	5	.4	11	2
Buttermilk	4	1	5	.5	14	2
Cow's, whole	3½	4	5	.7	20	2
Cow's, ½ skimmed	3½	2	5	.5	14	2
Cow's, skimmed	3½	tr.	5	.3	10	2
Cow's, evaporated	7	8	10	1.4	40	2
Dextrogen	6	6	18	1.5	43	2
Formulac	7	8	9	1.4	40	2
Goat's	3	4	5	.7	20	2
Human	1½	4	7	.7	20	2
Milk, Powdered						
Dryco, partly skimmed	32	12	46	4.2	119	6
Klim, whole	26	29	36	5.1	148	4
Klim, skimmed	35	2	51	3.6	103	4
Casec	88	2	0	3.7	105	6
Olac	23	19	53	4.8	134	4
Protein milk	37	27	26	4.9	144	4
Sobee	32	19	38	4.5	128	6
Lactogen	16	25	53	5.0	143	4
Malted, dry	15	9	71	4.3	122	3
Mellin's	10	tr.	80	3.6	102	4
Nestle's	15	10	70	4.3	122	4
Similac	12	27	54	5.1	145	4
S.M.A.	12	28	55	5.2	148	4
Sugars						
Cane	0	0	100	4.0	113	2
Karo, Blue Label	tr.	0	74	3.0	85	2
Lactose	0	0	100	4.0	113	3

FOODS USED IN INFANT FEEDING *(Continued)*

	% Composition			Calories per		Ounce Measurements tbsp.
	Prot.	Fat	Carb.	Gm.	Oz.	
Dextrimaltose	tr.	tr.	97	3.8	107	4
Smaco:						
Maltose-Dextrins	1	0	96	3.9	111	4
Dextro-Vitavose	5	0	87	3.7	105	4
Vitavose	15	0	78	3.7	105	4
Fruit Juices and Purées (Unsweetened)						
Apple sauce, strained	tr.	tr.	12	.5	14	2
Apricots, strained	1	tr.	25	1.0	29	2
Banana, ripe, strained	1	tr.	23	1.0	29	2
Orange juice, strained	1	tr.	12	.5	15	2
Prunes, strained	tr.	tr.	29	1.2	34	2
Vegetable Purée						
Asparagus, strained	2	tr.	5	.3	8	2
Beets, strained	1	tr.	8	.4	11	2
Beans, green, strained	1	tr.	4	.2	6	1
Carrots, strained	1	tr.	7	.3	8	2
Potato, baked	3	tr.	28	1.2	34	2
Peas, strained	5	tr.	8	.5	15	2
Spinach, strained	2	tr.	2	.2	6	2
Tomatoes, strained	2	1	6	.4	11	1

giving the baby water and orange juice. Bottles and nipples should be rinsed after each feeding and should be scrubbed with soapy water inside and out before they are sterilized. The hole should be tested to make sure there will be a good flow of liquid.

ORDER OF PROCEDURE

Sterilizing

Place rack in kettle.

Add water to depth of 2 inches.

Cover and bring to boil. (If cover is missing, fill kettle almost full.)

Scrub inside of bottles with soap and brush. Rinse. Place upside down in bottle rack. (If rack is lacking, place bottles on sides.)

Wash bottle caps and nipples in hot soapy water, rinse, put in jar with perforated top and place in kettle. (Turn each nipple inside out while washing.)

Put funnel, strainer, spoons and tongs in kettle.

Cover kettle, bring to boil and let boil 5 minutes.

Remove rack of bottles and let drain.

Remove long-handled spoon and tongs and lift out and drain water from jar of nipples. (Touch only handle of spoon or tongs and do not touch lip of jar.)

Leave remaining utensils in kettle until ready to use.

Sterilize lower part of long-handled spoon.

Preparing Fresh-Milk Formula

Take bottle of milk from refrigerator.

Wash top under running water and wipe with paper towel (unless there is an extra protecting cap).
Shake bottle and measure required amount of milk into saucepan.
Measure and add required amount of water.
Measure and add required amount of sirup or sugar into mixture and stir.
Bring to boil and boil 5 minutes while stirring constantly.
Strain and pour at once through funnel into bottles. (If bottles are not heat-proof, cool mixture by placing in pan of cold water and stirring.)
Cover bottles with sterilized caps and place at once in refrigerator. (Sterilized nipples may be placed on the bottles before they are covered with the caps.)

Preparing Evaporated-Milk Formula

Measure required amount of water into saucepan.
Add required amount of sirup or sugar.
Stir until dissolved.
Bring to boil and let boil 5 minutes and remove from heat.
Scald top of evaporated milk can by pouring boiling water over it and wipe dry with a paper towel.
Open can of milk and measure required amount into sterilized bottle and pour into saucepan.
Stir with sterilized spoon.
Pour mixture into bottles, cover bottles with sterilized caps and place at once in refrigerator. (Sterilized nipples may be placed on the bottles before they are covered with the caps.)

Preparing Dried-Milk Formula

Measure required amount of cold water and place in saucepan.
Add required amount of dried milk to water. (Use dry measuring spoon and level with knife.)
Beat with egg beater until milk and water have thoroughly blended.
Measure required amount of sirup or sugar into mixture and stir.
Bring to boil and let boil 5 minutes while stirring constantly.
Strain and pour at once through funnel into bottles. (If bottles are not heat-proof, cool mixture by placing in pan of cold water and stirring.)
Cover bottles with sterilized caps and place at once in refrigerator. (Sterilized nipples may be placed on the bottles before they are covered with the caps.)

Warming the Feeding

Remove filled nursing bottle from refrigerator.
Place in small deep saucepan of warm water.
Place over high heat until water begins to bubble.
Shake bottle occasionally so that milk will warm evenly.
Remove bottle cap and put on nipple taken from covered jar, unless nipple was placed on bottle before storage in refrigerator. (Touch only the rim.)
Test temperature of milk by shaking a few drops on inside of wrist. (It should be warm but not hot.)

SUPPLEMENTARY FOODS

Pediatricians differ widely on the time to introduce supplementary foods to the baby's diet. Some advise their use earlier than here stated, while others delay their introduction to a later period. Some pediatricians are advising the use of solid foods, even scraped meat, as early as the baby can take them. The authors have tried to present a conservative plan and one that seems reasonable from all points of view. It must be remembered that any dietary plan is more or less flexible and should be adjusted to meet the needs of the individual child.

Vitamin Supplements. Both breast-fed and artificially fed infants may need vitamin supplements as early as the third or the fourth weeks.

Fish-liver oil is one of the oldest and best-known sources of vitamins A and D. Jeans[7] advises that 15 drops once or twice daily may be given at the end of the first month and gradually increased until one teaspoonful is being taken each day throughout the period of infancy. Some other authorities advocate larger quantities. There is wide variation as to the amount of vitamin D in various oils, hence the quantity should depend upon the strength: 400-800 I.U. is considered a good daily dosage. When a lower fat intake is desirable, fish-liver oils which have a higher vitamin potency than cod-liver oil may be prescribed, a smaller quantity of oil, of course, being used. Jeans further states that when fortified vitamin D milk which contains 400 units to the quart is used, additional vitamin D is unnecessary. Not all pediatricians agree with his opinion. The Children's Bureau sums up the question as follows: "Some babies need only 400 units of vitamin D daily, but many babies need more than this amount. For this reason it is desirable to give all babies and small children 800 units daily in order to allow an ample margin of safety." The recommended dietary allowances by the Food Nutrition Board of the National Research Council[8] conforms to this view for the child under 1 year.

By the time the child is 3 or 4 weeks of age, orange juice diluted at first with an equal quantity of cool, boiled water may be given once a day, beginning with one teaspoonful and gradually increasing this amount to two tablespoonfuls, twice daily, by the end of the third month. Tomato juice may be substituted for the orange juice, but it is only half as potent a source of vitamin C. It does not need to be diluted.

Egg Yolk. There is some difference of opinion among pediatricians as to when egg yolk should be added to the baby's diet. Some advise it as early as the second month, others later. One drop of egg yolk should be given the first day, two drops the second, and so on until the eleventh day, when 11 drops are given. If this is well tolerated, the infant may be given half an egg yolk. The reason for this gradual introduction of the egg yolk is to develop tolerance in those infants who are sensitive to the protein of egg yolk. The egg white is not given because the additional protein is unnecessary and the child may be sensitive to it. The egg yolk may be soft-cooked, it may be poached, or it may be the tender yolk of a hard-cooked egg. Raw egg yolk may be beaten and added to the baby's milk or it may be mixed with the orange juice. It is advisable to serve the egg yolk in these small amounts until the end of the first year at least. At most not more than one yolk a day should be given. The egg yolk is a valuable contributor of iron, which other foods do not supply in adequate amounts.

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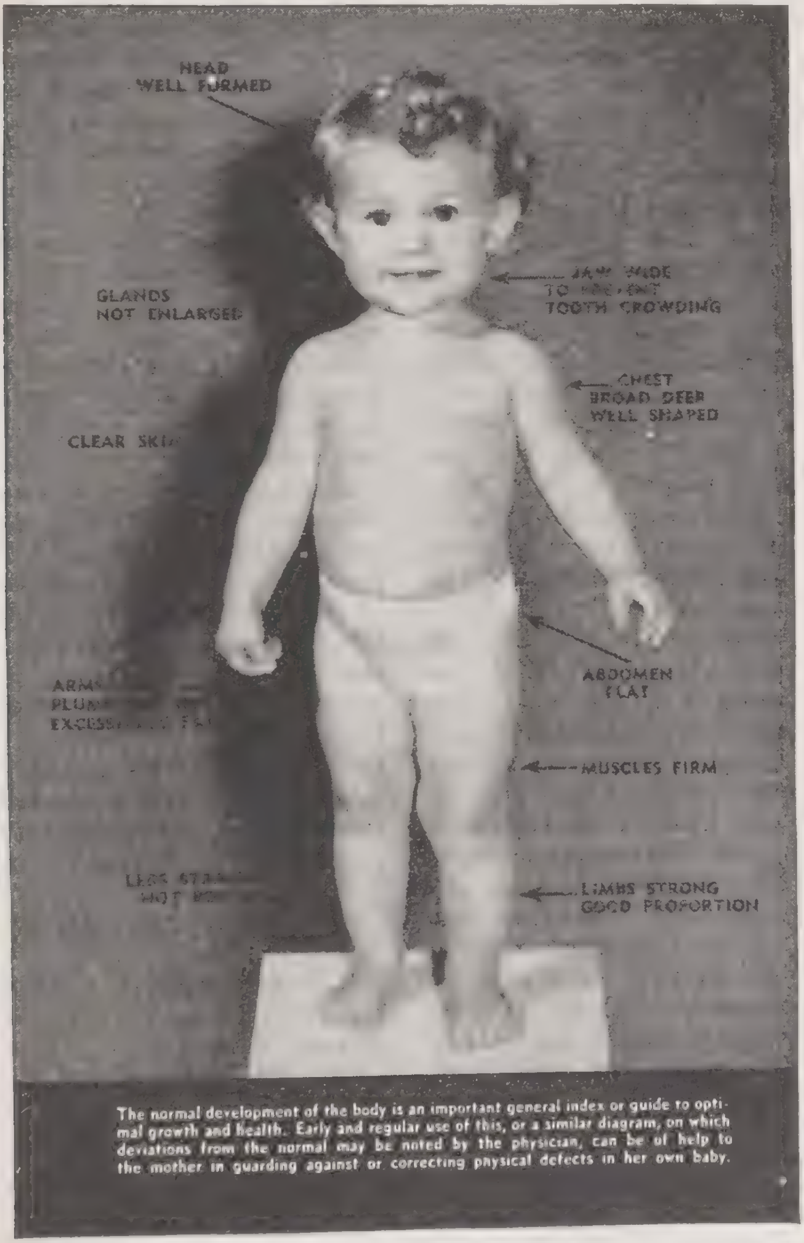
[7] Jeans, P. C., and M. Rand: Essentials of Pediatrics, Philadelphia, Lippincott, 1946.

[8] National Research Council: Recommended Dietary Allowances, No. 122, Aug., 1945.

Cereals. The baby should be introduced to cooked cereals when he is about 4 months old. Dry-cereal preparations and canned cereals especially prepared for infant feeding are available. The dry products must be mixed with warm milk or water, while the others need only be warmed. The cereals generally used by the family may be cooked according to the direc-



The normal development of the body is an important general index or guide to optimal growth and health. Early and regular use of this, or a similar diagram, on which deviations from the normal may be noted by the physician, can be of help to the mother in guarding against or correcting physical defects in her own baby.

Fig. 45. Healthy infant showing excellent development. (California Fruit Growers' Exchange.)

tions given on the package and used for the baby. Some physicians advise longer cooking. The coarse cereals may be strained, and all of them should be thinner than those prepared for the family. Only a small amount of cereal should be used at first, and this is given usually just before a midmorning feeding. The original small amount may be gradually increased and in a few months it may be of a thicker consistency. By the seventh or the eighth months, the baby will be taking from 2 to 5 tablespoonfuls twice during the day.

Vegetables. By the fifth month, or even earlier, vegetables should be introduced. Strained vegetables, fresh or canned, may be used, starting with 1 teaspoonful and gradually increasing to 4 tablespoonfuls by the time the child is 8 months old. Some babies will become accustomed to eating vegetables more quickly than others, with whom the introduction must be very gradual. Vegetables should be cooked according to the directions (Chap. 47, Vegetables) and put through a purée sieve or strainer, unless a canned ready-to-use product is chosen. Canned purées come in many varieties and they are most convenient to use. Green, leafy vegetables, including any mild-flavored green, as well as spinach, should be given several times a week on alternate days. Almost any vegetable which comes in canned puréed form or a fresh or canned vegetable which can be easily sieved may be used. Choice can usually be governed by what vegetable is to be served on the family table. Potatoes can be well taken, but they should replace cereal occasionally rather than another vegetable. For the first year, vegetables are not buttered, but they may be seasoned with a small amount of salt. Toward the end of the year, chopped vegetables may replace strained vegetables. Some pediatricians advise their use earlier than do others. Some children can take them earlier than others without digestive disturbances.

Fruits. In addition to orange and tomato juices, other juices such as grapefruit and pineapple may be given. By the ninth month, applesauce, mashed banana, apricot or prune purée and other stewed cooked fruits may be added.

Meat. Scraped lean meat or liver is introduced into the baby's diet at about 7 months in modern pediatric practice. Both may be cooked in a greased frying pan with just enough fat to prevent sticking. Canned puréed and chopped meats, ready to use, are now available.

Bread. Dried bread or zwieback should be given the baby after his first teeth have come through, as these hard foods are an aid in teaching him to chew properly. The sliced bread should be dried slowly in the oven so that it is crisp throughout. An enriched white bread or a whole-grain bread, but not a coarse bread, should be chosen. Crackers should not be substituted for bread in the first year, unless they are very hard. They do not give any exercise in mastication.

REVIEW QUESTIONS

1. Breast feeding is considered to be an advantage to the baby. For what reasons? When should breast feeding be avoided? If breast milk decreases in quantity, what methods to supplement it are used?

2. The amount of milk taken by an infant increases regularly. What is the rate of increase in the first week? After the third week?

3. The average baby is weaned be-

tween the sixth and the ninth months. What preparations should be made for it?

4. The premature infant needs more care than does a full-term baby. What precautions must be taken? How does his feeding schedule differ from that of a normal baby?

5. Cow's milk is generally used in infant feeding. How does it compare with human milk? What forms of cow's milk may be used, and what are the reasons which may influence the choice?

6. In preparing the milk formula there must be dilution and additions. For what reasons? What are the additions generally used?

7. Babies should be weighed at least once a week. What should be the average gain? Should it correspond to the increase in the amount of food? Must the gain be consistent from week to week?

8. Feeding at regular intervals is generally advised for the young infant. Plan formula and feeding schedule for a baby 5 months old and weighing 14 lbs.

9. The preparation of the formula depends upon the type of milk used. What procedure is common for all? Why is it of such importance? In what respect does the preparation of the canned-milk formula differ from the methods of other types of milk? For what reasons?

10. The choice of the type of milk may depend upon circumstances. What type of milk would you suggest for a young mother traveling with a baby across the United States? Why?

11. Supplementary foods are introduced into the baby's diet gradually. What is the first supplement generally advised and in what amount? In what order are other supplements introduced? Suggest reasons for their introduction. Plan a day's diet for a normal well baby 9 months of age.

17

Nutrition for Growth

Chapter Topics

DIET IN EARLY CHILDHOOD
ESTABLISHING GOOD FOOD HABITS
ELEMENTARY SCHOOL AGE
HIGH SCHOOL AGE

The influence of diet on the development of the infant has been shown to begin during the months of the mother's pregnancy. The proper feeding during the first months, whether by breast milk or by artificial formula supplemented according to modern practice, has been shown to be a large factor in reducing infant mortality. The introduction of other foods in small quantities at the proper time during the first year according to modern practice has been found successful. In the following preschool years, the gradual education of the child's tastes must be carried on until he is ready to share the regular family diet. During the whole school period stress should be laid on good food habits and a rounded diet. The foundation for adult health is laid in childhood and food plays a large part in establishing a status which enables the adult to contribute to community life and to enjoy the benefits of good health. The application of the science of nutrition beginning before birth and carrying on through the years may be responsible for increasing the length of the period of greatest efficiency and for delaying the approach of the symptoms of old age.

DIET IN EARLY CHILDHOOD
(Preschool Age)

A study of height-weight-age tables shows that the modern infant makes more rapid gains in weight and in height for its age than the child of even two decades ago. A better diet is no doubt responsible for this. The average child at 1 year of age will have increased in height 9½ inches and will weigh between 21 and 23 pounds. It must be remembered, however, that inheritance is a large factor in determining body build. Short, stocky parents will probably have children of the same general build, just as tall parents will produce children of similar height. Both height and weight increases are correspondingly less as age increases. For example, the average gain in height during the second year is only 4 inches, while the weight will be approximately four times the birth weight or approximately 28 to 30 pounds.

The diet of the 1-year-old differs only slightly from that described in the previous chapter. It will, of course, include approximately 1 quart of milk per day and the supplementary foods previously described. The number of feedings will be reduced to 4 or 5 per day and the bottle will have been supplanted by the cup and the spoon.

During the second year more solid foods will be added: for example, finely chopped vegetables and fruits in place of strained products; ready-to-eat cereals, as well as hot cereals; chopped liver, lean meat, fish and poultry in small quantities almost daily. Eggs will sometimes be used instead. Cottage and cream cheese and mild American cheese in combination with other foods may also be used occasionally; custard and simple puddings are served and butter or margarine fortified with vitamin A is used with toast or zwieback. The child's food should be prepared simply, and all fried foods, rich pastries and cakes should be avoided. Coffee, tea or soft drinks containing caffeine should not be offered to young children.

The basis of the diet should remain the same during the preschool period, the child being introduced gradually to the foods used on the family table. If the child continues to take a quart of milk a day, servings of meat and other protein food may continue small. He should not be encouraged to drink more than this amount of milk, as in this event appetite for other foods may be lacking. If he eats well the other foods offered at a meal, 1½ pints of milk may be enough for his needs. Some of this may be used in the soups, custards or other desserts offered at mealtime.

The child must be introduced gradually to the family 3-meal-a-day schedule. A midmorning and a midafternoon lunch at a regular time should be planned for the younger children and may be continued if this custom does not interfere with appetite at mealtime. Milk, fruit juice, sometimes accompanied by bread, crackers or plain cookies may be given. Rich cookies, cake and candy should not be taken between meals but reserved, if used at all, for dessert at the end of a meal.

Establishing Good Food Habits

It is extremely important that the child's training to establish good food habits be begun during the first year and continued through childhood. The meal hour should be one of peace and quiet. For this reason children are often served apart from the older members of the family. Tension and unpleasantness during the meal hour will often destroy the child's appetite and quite frequently cause indigestion. The meal hour should be one of the pleasant occasions of the day. It gives the mother an opportunity both to visit with her child and to teach him respect for good food and desirable habits of eating (manners as well as food tastes).

The child whose appetite is meager will best be served by having one dish at a time placed before him rather than the whole meal. The child has a "single-track" mind and should, therefore, not have his interest in one food distracted by others, especially when the others are more attractive or alluring. Children usually prefer to take one food at a time rather than to mix them. The foods should at least be served in courses, each one being a surprise. Children are great imitators; they often partake of food simply because "Daddy" or "Mother" does. Parents should, therefore, set a good example by including in their own diet foods known to be essential for good body building. Unfavorable comments regarding wholesome foods should be strictly avoided.

FOODS INCLUDED IN A GOOD DAILY DIET FOR CHILDREN FROM 1 TO 6*[1]

Food	Amount Needed by Each Child Daily	Average Size of Serving for Each Age		
		1 Year Old	2 and 3 Years Old	4 and 5 Years Old
Milk	3 to 4 measuring cups	1 cup as a drink at each meal		
Eggs	1 egg	1 whole egg		
Meat, poultry or fish	½ to 2 oz. (2 to 4 tablespoonfuls)	½ oz. (2 tablespoonfuls)	1½ oz. (3 tablespoonfuls)	2 oz. (4 tablespoonfuls)
Dried beans, peas, lentils	1 serving 2 or 3 times a week when meats and eggs are hard to get	Strained in soup	3 tablespoonfuls	4 tablespoonfuls
Potatoes	1 serving	2 tablespoonfuls	3 tablespoonfuls	4 tablespoonfuls
Other cooked vegetables (a green leafy or deep-yellow vegetable often)	1 to 2 servings	2 tablespoonfuls	3 tablespoonfuls	4 tablespoonfuls
Raw vegetables (lettuce, carrots, celery, tomatoes, etc.)	Small amount	....	A small piece or two	
Fruit for vitamin C	1 medium-sized orange or ½ to ¾ cup tomato juice	Whole day's amount in one serving		
Other fruit (apple, banana, peaches, prunes)	1 to 2 servings	¼ cup	⅓ cup	½ cup
Cereal, whole-grain, restored or enriched	1 serving	¼ cup	⅓ cup	½ cup
Bread, whole-grain or enriched	1½ to 5 slices	½ to 1 slice	1 to 1½ slices	1½ to 2 slices
Butter or fortified margarine	1 to 2 tablespoonfuls	1 teaspoonful	1 to 3 teaspoonfuls	1 to 3 teaspoonfuls
Sweets	A simple dessert at 1 or 2 meals	¼ cup	⅓ cup	½ cup
Fish-liver oil	Enough to provide 400 to 800 U.S.P. units of vitamin D †			

* All measurements in this chart are level, measuring cups and measuring spoons being used.

† For approximate amounts of vitamin D in different preparations see Substitutes for the Sun (Children's Bureau Folder 25, Washington, 1940).

A mother is often overly anxious about her child's food and displays this anxiety before him. A child's appetite may of course vary, just as does that of an adult: because he does not drink his full quota of milk at one meal does not mean that the lack will not be made up at the next one. There is much virtue in expecting the child to eat the things set before him. A child who is scolded and made to feel that he is being coerced into eating certain foods is sure not to want it and will more than likely fight for his "rights." Undue nagging is undoubtedly responsible for many of the so-called food-problem children.

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[1] U. S. Department of Labor, Children's Bureau: Your Child from One to Six, Publication No. 30, rev. 1945.

If a child must be trained to like some unfamiliar food, this should come at the early part of the meal while he is still hungry, and the food should be given in very small quantity. The child may be given to understand that the tasting of the food is prerequisite to the rest of the meal. However, if the child is properly trained in his food habits from the beginning this will rarely be necessary. Bribery is usually bad psychology, since a child soon learns to classify food unpleasantly, as with medicine. Firmness and tactfulness on the part of the mother are never more necessary than at the child's mealtime. As already stated, the most effective plan is to expect the child to eat the food set before him. Mothers who carry through successful food programs must have faith in their ultimate success.

Children differ greatly in their natural desire for food. Long-term studies such as those conducted at the Yale Clinic of Child Development emphasize that fact and also that appetite runs in cycles. A complete summary of eating behavior of children at different age levels from 1 to 10 is given by Gesell and Ilg.[2] Notable in this summary are the "refusals and preferences" which should be familiar to every mother, nurse or dietitian dealing with children. For instance, "finicky" food habits and food jags are characteristic in the years from 2 to 4. The 5- to 7-year-olds dislike casserole dishes, mixtures, fat meats and gravies. They like raw vegetables better than cooked ones, but dislike strongly flavored cooked vegetables, the root vegetables especially being in disfavor.

Preferences also change with age and should be respected by mother or nurse. Nutritional requirements can

Fig. 46. The right start for the baby. Liking comes through learning to like. Teach the flavor of a variety of foods early. (Gesell and Ilg: Feeding Behavior of Infants.)

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[2] Gesell and Ilg: The Child from Five to Ten, New York, Harper, 1946.

be met in spite of this changing pattern with age. The 5-year-old prefers plain food such as meats, potatoes, raw vegetables, milk and fruit. By 6 he is willing to try new foods, and the liking for peanut butter starts then and increases to "its 7- to 8-year-old pinnacle of preference." By 7 he is beginning to accept previously disliked foods, and by 8 there is a ravenous appetite with few refusals but strong preferences. Food may be judged by odor or color, and food served attractively makes an impression. By 9, the child usually has a keen interest in food, likes to help prepare it, and is positive in his likes and his dislikes. Some will eat everything at this age, but plain foods still are preferred. Puréed foods and fat on meat continue to be disliked. The authors particularly stress the deep-seated growth reasons which seem to underlie these changing preferences and refusals.

Average weight for age with a range which depends upon the body framework should be checked regularly. If a child is much below or above the average, the food intake should be checked for its caloric content. Deficiencies of other essentials, such as those which influence appetite, may also affect weight. Symptoms of these will be detected during the regular examinations by the private or the clinic pediatrician and measures taken to offset them.

ELEMENTARY SCHOOL AGE

New problems with regard to the regular routine of feeding which has been established in the first years may occur when the child enters elementary school. Contact with other children who have been allowed a greater variety of food and who are accustomed to eating sweets between meals may cause a child to question his own schedule, which he has taken for granted. The excitement of new experiences may sometimes interfere with digestion and appetite, especially if a fear of being late is developed. It is important that there should be plenty of time for the eating of an adequate breakfast, and lunch also when there are two sessions and the child comes home for this meal. If he takes lunch at school and there are no provisions for a hot meal, the box lunch which he carries should be planned to supplement the home breakfast and dinner. The evening-meal plan for the child must take into consideration the type of midday meal which he has had. He may need a light lunch after he returns from school, but it should not be of such character as to take away appetite for the early dinner.

Gesell and Ilg[3] state that there is usually a steady rise in appetite from 5 years on—"By 9 years nearly all children have a vigorous and generous appetite." They call attention to the fact that it is not wise to expect uniform levels of appetite, however, throughout the day. "Breakfast is the poorest meal; even though one might wish to insist that it might be otherwise. At many ages there is marked variability from meal to meal. But again, such variability tends to decrease with increasing age." The authors call attention to the inadvisability of overstressing the development of good table manners which are often of so much concern to mothers at this period. "From a developmental standpoint graceful table manners constitute a minor problem. . . . Under ordinary conditions the 'man

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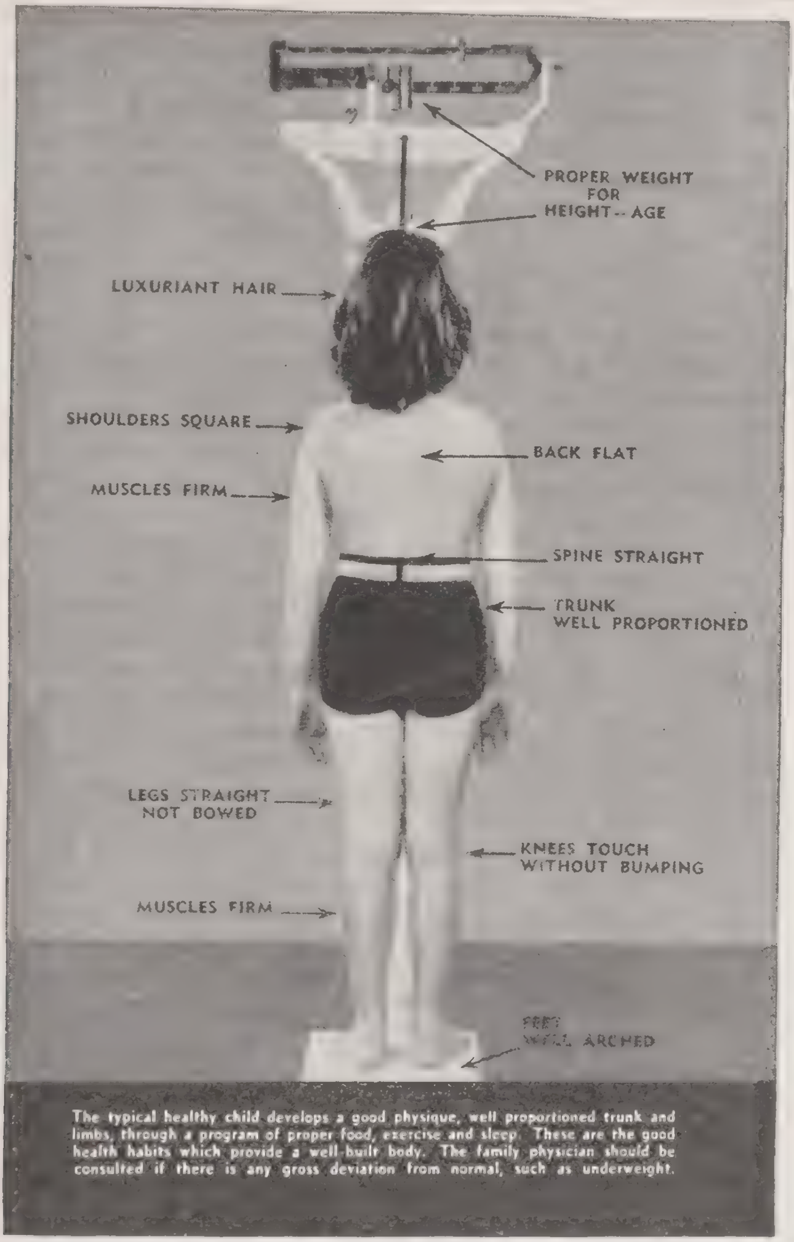
[3] *Ibid.*



The typical healthy child develops a good physique, well proportioned trunk and limbs, through a program of proper food, exercise and sleep. These are the good health habits which provide a well-built body. The family physician should be consulted if there is any gross deviation from normal, such as underweight.

Fig. 47. Healthy child showing a well-built body. (California Fruit Growers' Exchange.)

ners' improve with age (rather than with scoldings)."

Effort should be made during this whole period to establish a catholic taste for all good food. Food prejudices should be discouraged and a taste for raw vegetables in salad form should be encouraged by serving them regularly. In general, meals should be simple, fried foods and rich desserts being served only occasionally. If children are taught that there are certain dishes which are appropriate only for adults and if foods which they like are provided, they will not expect to partake of every food offered at the family meal.

If a hot lunch is served at school under good supervision, it will sometimes help to combat home food prejudices, as children are inclined to adopt the customs of a group. The greatest importance of a good school lunch, however, is the opportunity it affords the children of working mothers to procure an adequate meal at a low price.

The school-lunch program which with Federal support was widened during the depression and still further during the war, has received wide approval. Efforts are now being made to put this on a permanent basis through the efforts of educators and nutritionists and civic organizations. Many states have made small or generous allotments of funds to supplement Federal funds. To function efficiently, provision should be made for educating the children in the choice of the proper food, not only for lunch but for other meals. The Better Breakfast Campaign instituted in several cities and sponsored by health and civic organizations, industrial plants and business organizations, as well as by the schools, is believed to have produced effective results.

Physicians in examinations of school children are beginning to detect early symptoms of dietary deficiencies. While it is recognized that one deficiency seldom exists by itself, evidence of one calls for a check of the whole dietary picture. Symptoms such as circles under the eyes, granulated conditions of the eyelids and scaliness on the skin of the arms and the legs may indicate a lack of vitamin A. Sores in the corner of the mouth and crusted eyelids may be signs of a riboflavin deficiency. The bleeding of tender gums is often the result of low vitamin C in the diet. Abnormal formation of bones indicates an earlier rachitic condition. The school nurse who is familiar with the evidences may call the attention of the school physician to children needing a special examination. In New York City a special nutrition clinic is conducted by Dr. Norman Jolliffe at the East Side Health Center, and children who show evidence of malnutrition are referred there for diagnosis and treatment. Diagnosis is made by blood and urine analysis, as well as by clinical symptoms. The dietitians attached to the clinic recommend dietary changes and the physician may prescribe vitamin concentrates.

It is recognized that mental development is often influenced by the nutritive state. A child hungry for any dietary essential is less likely to respond to classroom teaching than one who is well nourished in every respect. Kugelmass [4] in 1944 reported extended observations on the I.Q. improvement of children over a period of 14 years. Children malnourished at the time of the first test and subsequently well nourished showed marked improvement, while those who were well nourished to start with showed no change on the average. Harrell,[5] in a different type of study with matched pairs of children, found that children whose diet was supplemented by one dietary essential (thiamine) showed significant improvement in performance when compared with children who received only a placebo. The 18 tests used included acuity of vision, skills at games, reaction time, reading, arithmetic, memorizing and intelligence tests currently in use by psychologists.

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[4] Kugelmass, I. N.: Am. J. M. Sc. 208:631, 1944.

[5] Harrell, R. F.: J. Nutrition 31:283, 1946.

Surveys of nutritive conditions and food habits of school children under the direction of the U. S. Public Health Service and other sponsors in both cities and rural communities have shown physical symptoms of deficiencies of various dietary essentials. These occur in many sections of the country. A report from Vermont of a survey conducted by the State Nutrition Committee [6] is summarized as follows:

"A survey of the nutritive status of 386 Vermont school children, selected so as to represent rural and urban groups of various ages and economic levels, has been made. A review of the food intake showed the greatest fault to lie in the low intake of fruits and vegetables. Blood studies revealed that 25 per cent of a group of 176 children had plasma vitamin C levels below 0.6 mg. per 100 cc., and on physical inspection 40 per cent of the entire series had inflammation of the gums of varying intensity. Severe forms of spongy, bleeding gums were found in only a small percentage of the children.

"Six per cent of 170 children had low hemoglobin values suggestive of a mild anemia. Urban children had higher hemoglobin levels than did rural children. Skeletal changes usually associated with rickets were found in about 85 per cent of the children. The signs chosen were looked for with extreme care, and even minor deviations were included. Signs associated with a shortage of riboflavin were also found in a small percentage of the children, but they cannot be accepted as definitely indicating any serious deficiency of this vitamin.

"Some degree of folliculosis, at least of the outer aspect of the arm, was found in 40 per cent of the children, and five of these subjects had a generalized folliculosis of a marked degree. Mild cases of follicular conjunctivitis were frequent. Premature loss of the teeth and dental caries were found to be extremely prevalent, even on gross examination with a good light and a tongue depressor."

From the southern state of Florida comes a report of a nutrition survey [7] conducted by Dr. Walter Wilkins under the sponsorship of the U. S. Public Health Service. Excerpts from the summary of the survey findings follow:

"During a period of several weeks approximately 1,000 school children in five widely scattered Florida counties were examined for signs suggestive of malnutrition. Of this group 75 per cent were white children, 25 per cent Negroes. Although slightly less than one fourth of the youngsters attended rural schools undoubtedly the home surroundings of nearly one half could be considered rural.

"It is common knowledge that a certain type of rash is usually a sign of measles. Just so, there are certain other readily observable physical findings which are usually signs of specific deficiency conditions. Each child was given a brief examination designed to find these signs if they were present and to grade them according to severity.

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[6] New England J. Med. 233:617, 1945.

[7] Florida State Board of Health: Florida Health Notes, Nutrition Survey Number, vol. 37, No. 5, May, 1945.

"Vitamin A deficiency is often associated with a granulated condition of the eyelids and a peculiar bumpiness or scaliness of the skin. Therefore eyes and skin, particularly of the arms and the legs, were examined.

"Mouths were inspected for scarring or actual sores at the corners, and eyelids examined for crusting along their margins. Both of these signs often occur in persons whose diet is lacking in vitamin B_2.

"Tender, spongy gums which may bleed easily are frequently danger signs of vitamin C deficiency. Gums were checked for signs of this deficiency which in its more serious forms is known as scurvy.

"Head, chest and knees were examined for superficial signs suggesting rickets, past or present. One cannot say specifically that these mean a lack of the 'sunshine vitamin,' vitamin D, alone. Lack of other substances such as calcium or phosphorus may also be involved. Consultation with parents, however, usually revealed that little or no cod-liver oil or other source of vitamin D had been given to supplement the vitamin D which the skin itself forms when exposed directly to sunlight.

"Anemia exists when the hemoglobin or red portion of the blood falls below a certain level. Nutritionally this may be due to lack of iron, protein, vitamins B or C—any one or all of these. To determine whether or not the children were anemic, blood hemoglobin tests were made whenever possible.

"Hookworm testing was carried out by means of laboratory examination of stool specimens. No person infested with hookworms can experience the best possible health. Regardless of adequate diet, he will likely develop anemia and often other deficiency conditions."

A study of the health needs of Chicago children[8] from 2 to 17 years showed that the general physical condition of 2 out of every 3 children was under par. More than 50 per cent showed symptoms of nutrition deficiencies. About half the group were Negroes and their diets in most cases were more often below recommended allowances than were those of the white children. Fruits and vegetables were especially deficient. Twenty-nine per cent of the children had inadequate milk intake. Even in families where it was possible to have milk delivered without charge upon request, there was an insufficient intake of milk. In the families where there were no arrangements for this supplementation, 41 per cent were insufficiently supplied with milk. Three out of 4 children were on diets below those recommended by the National Research Council in at least one of the protective foods, such as milk, fruit and vegetables, meat and meat substitutes and eggs.

These dietary studies carried on in rural and in urban communities in various parts of the country indicate the need of a national program which will include the supplementation of the diets of children through the school lunch and education in the choice of the proper food in order that good dietary habits may be established.

HIGH SCHOOL AGE

Growing girls and boys both need a large amount of food through the adolescent period, for research has shown that the basal metabolism is greatly increased during this period. The appetites of the boys usually need no stimulation. Girls, however, often suffer from loss of appetite during this period. The importance of their home breakfast, as well as their lunch at school, should be stressed. The girls should be shown the necessity for a liberal supply of iron, which may prevent the anemia to which young girls are often subject.

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[8] Hardy, M. C.: Soc. Serv. Rev. 19:201, 1945.

The girls who are attempting to reduce, or to keep thin, may often be made aware of the importance of choosing plenty of milk, vegetables and fruit by being shown their good effects on the complexion. Girls should be brought to realize that underweight may be a serious thing, since in the young it retards growth, impairs efficiency and reduces resistance to disease. It has been found that despite the general decrease in tuberculosis, its incidence has increased in young women between 15 and 24 years of age. Physicians are inclined to attribute this condition to the fad of slenderizing.

A comparative study of the diets of students in private and in public high schools in New York City reported by the Milbank Memorial Fund[9] shows that high-income level and culture are not complete assurances that food intake will be adequate in every respect. The average intake of the private-school pupils generally exceeded recommended allowances of the nutrients, protein, iron, calcium, vitamin A and ascorbic acid which were included in the study. Both boys and girls, however, fell below the recommended level of calcium per kilogram, and the girls were short in iron per kilogram. The public-school pupils generally had a lower average of these nutrients, and the total intake was seldom more than equal to recommended standards and sometimes fell below them. Certain racial differences were noted. In the Jewish group, the diets contained larger amounts of calcium and vitamin C than did those of the group of Italian parentage, while the latter group was higher in vitamin A.

The health records of high-school students in general are becoming increasingly better. The regular physical examinations in the grade schools have done much to correct infections of eyes, ears, nose and throat and to protect from contagious diseases. Most students who enter high school come from families from a better-than-average economic level and have generally had a better opportunity to establish good food habits. In the last decade, according to Dr. H. C. Sherman, professor of nutrition at Columbia University, nutrition has become a factor in social science. The generations finishing high school and attending college today will be the first to profit to the full extent from the application of this science from conception through adolescence. This is evidenced by an increase in the average stature and by greater vitality. Dr. Sherman prophesies an increase in the years of efficiency as well as a longer life span.

REVIEW QUESTIONS

1. Increases in height and in weight are criteria by which the development of a child may to some extent be judged. Discuss the gains which are made by the average child. What factor may modify average body structure?

2. During the second year certain changes are made in the diet plan.

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[9] Wiehl, D. G., and K. Berry: Milbank Mem. Fund Quart. 23:353, 1945.

What additions should be made? What foods should be avoided?

3. The child should be introduced gradually to the family's 3-meal-a-day schedule. What precautions should be taken?

4. Foods included in a good daily diet for children from 1 to 6 increase in amount and in size of servings. Plan a day's menu for an active child of 5 years.

5. It is important to establish good food habits in the early years. Outline factors other than the supplying of adequate food that are important. Criticize methods which are sometimes used to entice a child to eat.

6. New feeding problems may occur after a child enters elementary school. What are these, and how may they be met?

7. Efforts are now being made to put the school-lunch program with Federal support on a permanent basis. What should this program include?

8. Evidences of certain dietary deficiencies are shown by a variety of symptoms. What are these symptoms? What deficiencies may they indicate?

9. A survey among Vermont school children showed a low intake of fruits and vegetables. For what symptoms was this responsible? What dietary essentials were lacking?

10. A nutrition survey in Florida also showed deficiencies. Compare this report with that from Vermont.

11. Both adolescent boys and girls need a large amount of food. Compare the appetite demands at this period.

12. The health records of high-school students are becoming increasingly better. For what reasons?

18

Nutrition for Adults, Young and Old

Chapter Topics

THE PROBLEM OF ADULT NUTRITION
OUR AGING POPULATION
PROLONGING ACTIVE MIDDLE YEARS
FOOD HABITS AND FOOD NEEDS OF OLDER PEOPLE
THE USE OF VITAMIN CONCENTRATES
FOOD FADS AND FALLACIES

THE PROBLEM OF ADULT NUTRITION

For years in the science of nutrition major attention has been paid to the food requirements for growth—to child nutrition in particular. The time has come for more consideration of adults, both young and old. Webster defines an adult as "a person . . . who has reached maturity or attained full size and strength." It is apparent today from numerous studies that many adults never did attain their potential "full size," nor are they able to maintain "full strength" if they ever attain it. Good nutrition is only one of the health practices which help in maintaining strength and vigor, but it is one which can be practiced more often and is abused more frequently than any other.

Occasionally people with exceptional heredity may be able to maintain vigorous health throughout life without apparent effort or precautionary measures; but certainly the surest foundation for a long period of usefulness and activity is that laid in childhood and preserved through youth and adult life. The relative values of scientific health engineering and heredity are already beginning to show up in the physical and mental development of the present generation. It is a statistical fact that boys and girls entering colleges during the decade ending in 1943 were taller, though younger, than their predecessors of a generation earlier. This trend in our young people is undoubtedly due to better health practices while they were children. The same factors are also contributing to better health and strength in our adult population, but there is still room for improvement.

Sherman is a strong advocate of "the nutritional improvement of life" and has ably expressed his ideas on the subject in a series of articles[1] under the title of "Nutrition Engineering." His introductory paragraph is as follows:

"Every time a farmer grows a really good plant or animal, he is demonstrating a fact and principle that people have been slow in applying to themselves. This is the fact that full health is more than merely freedom from disease; rather, it is a positive quality of life that can be built to higher levels. To generalize this fact, and give it a formal scientific aspect, we may call it the principle of the improvability of the norm."

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[1] Sherman, H. C.: Nutrition Engineering, J. Franklin Inst., July, Aug., Oct., Nov., 1944.

It has been recognized for centuries that signs of senility might be deferred, but few people were concerned until it was too late. Roger Bacon, the scientific monk of the thirteenth century, claimed that the three causes of old age were infection, negligence and ignorance. With regard to aging, Bacon said:

"No one wishes to take thought in regard to methods of prevention, not even physicians, since we see that scarcely one physician in a thousand will give this matter even slight attention. Very rarely does it happen that one pays sufficient heed to the rules of health. No one does so in his youth, but sometimes one in three thousand thinks of these matters when he is old and approaching death, for at that time he fears for himself and thinks of his health. But he cannot then apply a remedy because of his weakened power and senses and his lack of experience."

As a method of attack on the problem Bacon suggested "that the wonderful and ineffable utility and splendor of experimental science may appear and the pathway may be opened to the greatest secret of secrets." Experimental science is pointing the way as Bacon predicted, but human nature has not changed greatly since his time.

It is not surprising that this complex human machine of ours gets out of order occasionally; the wonder is that it does not do so more often when it is given so little intelligent care. The delicate organs and tissues of the body continue to do their respective jobs for many decades if given half a chance. No one expects a man-made machine to last as long as that without special care and renewal of parts. Nature has a remarkable ability to repair or compensate for worn-out or injured parts if given the opportunity and the right materials. As Sherman has put it: "It is becoming increasingly clear that, however important the inherited constitution, there is yet a great opportunity open to each of us to provide for such a favorable internal environment as shall permit each person's native endowments to develop and function most effectively, so that the individual finds fullest satisfaction in life and at the same time renders service of the greatest social value."

None of us is too young to begin thinking about improving the health of later years. People buy annuities and life insurance for the future; why not consider other steps which may give even greater security and comfort?

OUR AGING POPULATION

The aged and the aging should be clearly distinguished: the aged are people, aging is a process. According to Stieglitz:[2] "Aging is continuous. It begins with the onset of life at conception; it can be terminated only by death. Aging may be defined, perhaps, as those changes which are introduced by the factor of time in living." Thus birth, growth, maturation and senescence are all part of the normal aging process. Aging proceeds more rapidly during the growing years because change is more rapid at that time. In the adult the aging process slows down and the rate of this change may be further retarded and the active period of life may be extended by good health practices.

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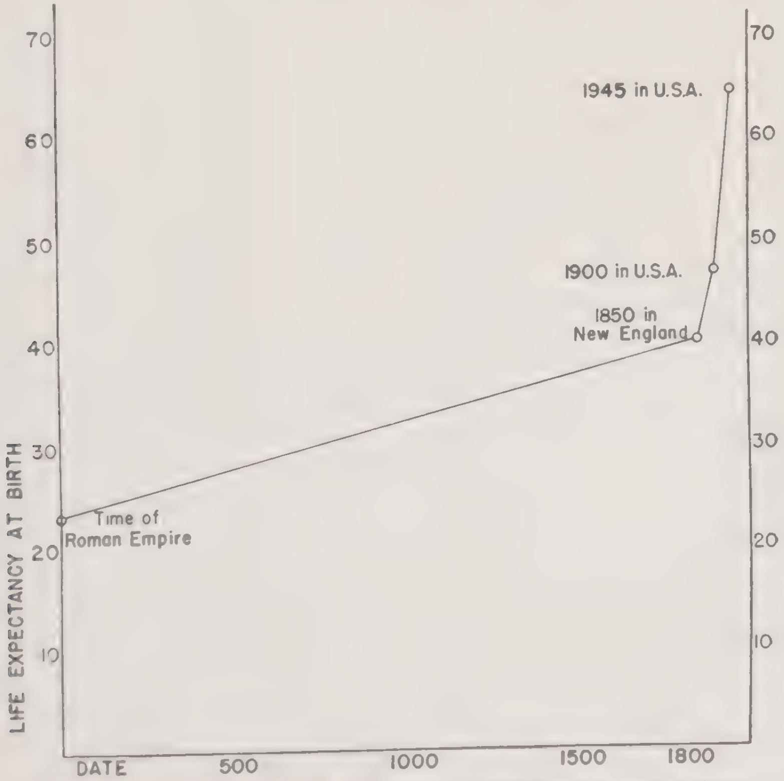
[2] Stieglitz, E. J.: Geriatric Medicine. Philadelphia, Saunders, 1943.

Adult nutrition problems deserve and demand consideration even more as our adult population increases. Less than half the population was over 20 years of age in 1850, 59 per cent was over 20 in 1920 and 69 per cent will be over 20 in 1950, we are told. The nutrition of this 69 per cent of the population is the subject of this chapter, "Adults, Young and Old."

The life expectancy has increased at an unprecedented rate in the last century—since modern sciences have made it possible for more babies to live to grow up and for more people to live to grow older. From the accompanying graph it may be seen that it was slow progress from the period of the Roman Empire, when the life expectancy was 23 years, to 1850 in New England, when it was 40 years. The rate of increase from 47 years in 1900 to 63 years in 1940 if extended, indicates future possibilities which may be changed by many factors.

The fact remains that the present rate of increase in the number of people over 65 years of age is almost five times that of the increase in the whole population. There were approximately nine million people over 65 in 1943. The progress in health sciences, which is primarily responsible for this increase, is the control of infections and communicable diseases. Medical science knows less about degenerative and chronic diseases of middle and old age, but the



Compare life expectancy in this century with that in earlier times.

study and the practice of geriatrics is making progress in recent years and nutrition is an important phase of prevention and treatment.

PROLONGING ACTIVE MIDDLE YEARS

Food can exert a profound influence upon vitality and longevity, but it is the former which will be dealt with in these paragraphs. As Sherman has expressed it:

"A striking aspect of the nutritional improvement of life is that, with food habits guided by present-day knowledge, full adult capacity and efficiency can be reached at an earlier and held till a later age in the same individual. This means both higher attainment and the holding of one's highest capacity for service and for enjoyment of life over a longer time.

"Because it had been regarded as established that 'longevity depends on heredity,' even scientifically trained people have been (perhaps still are) a little slow to assimilate the now fully demonstrated fact that both heredity and nutrition are major factors in determining the length of normal lives.

"The extra years which the science of nutrition offers, whether these be estimated at seven or ten or more or less, are not to be thought of as added to age. Rather, they are inserted at the prime (in any life that was not begun too soon to get the full benefit of the newer knowledge). In social-economic terms this means a continuation of the current increase in adult expectation, and with a smaller percentage of years of dependency.

"Thus, as each of us decides his food habits, he practices (whether consciously or not) his individual sort of nutritional engineering of his own life processes, and thus of his career."

Nutritional indiscretions among adults are not confined to any particular class, although the problems among low-income groups are apt to be greater. Too much, too little or the wrong kind of food, each is a problem for special consideration. Famine conditions in certain countries of Europe where scientific observations have been reported throw light on the effect of the quantity of food and the incidence of certain diseases. Stare[3] found that in northern Holland throughout the winter of 1944-1945 the average caloric intake for adults was estimated at from 1,200 to 1,400 and in March and in April, 1945, at from 800 to 1,000 calories. Clinical evidence of real starvation was abundant in all urban areas, the most common symptoms being loss of weight, edema, with weakness, fatigue, diarrhea and muscle pains frequent complaints. Tuberculosis increased 4 to 5 times and intestinal diseases, ulcer and hernia had greatly increased. "Interestingly enough, heart disease, hypertension and obesity had greatly diminished," says Stare. Vital statistics in this country show heart diseases, hypertension and other chronic diseases associated with obesity at the top of the list of causes of death or of chronic disability in middle-aged people. On the other hand, tuberculosis, ulcer and diseases associated with emaciation are well toward the bottom of the list as causes of death. Insurance companies also have long been warning *more* against overeating than undereating among adults in the United States.

Weight control is one of the first things to watch. To be really fit, body weight should be not more than 10 to

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[3] Stare, F. J.: Nutrition Rev. 3:225, 1945.

15 per cent above or below the desired weight for height and build. Appetite is a poor guide when it comes to controlling calories. There are height-weight tables in the appendix of this book and a complete table of food values for those who wish to calculate their diet. The reader is also referred to the more complete discussion of overweight and underweight (Chap. 20).

Perhaps one of the most common errors among adults in sedentary occupations is to watch calories without considering whether the calories they choose are in good company. Too often breakfast is omitted or is exceedingly sketchy, and lunch is hurried and poorly chosen. The main meal at night, even though well planned and prepared, can scarcely be expected to make up for poor choices at the other two meals. A personal check-up on food habits with a checking or a scoring device is often a spur to action. The body needs just as much good protein, minerals and vitamins when losing weight as when it is normal. It is more difficult to get enough protective factors when eating a lower total quantity of food, and therefore the choice has to be watched more carefully.

The nervous strain under which business executives and professional people frequently work can be tolerated only by a body in prime physical condition. Men and women in our factories today are protected from industrial hazards, but only recently has the provision of the right food for physical stamina had recognition as an important phase of industrial-health work. The nutritional indiscretions and deficiencies during the active period of life may not strike abruptly, but they take their toll in inefficiency, minor ailments, discomforts and increased susceptibility to infections. Premature senility is not inevitable, but it is all too frequent among workers who expect a body to continue to function normally after years of poor food habits. Men and women past middle life should be able, because of their experience, to make the best contribution to humanity. The lengthening of the active period of life would permit many people to contribute more richly and more completely to the well-being of families and communities.

FOOD HABITS AND FOOD NEEDS OF OLDER PEOPLE

Undoubtedly the greatest factor in the prevention of senility is the adoption of a suitable diet. It has been demonstrated repeatedly by animal experiments that by raising the amounts of protective foods beyond those considered essential for normal growth and maintenance, the life span of the animals is increased and the period of vigorous activity and health is extended well into what would be considered old age for that species.

Not only the quality but the quantity of food may also be important. Undereating and overeating both constitute problems, but the latter is more common and more serious from the standpoint of healthful longevity.

One of the marked changes in old age is decreased metabolism—a lowering of the bodily fires. Metabolism is reduced from 10 to 50 per cent as age advances. At the same time bodily activity is decreased, so that the caloric need is also reduced. A total intake of 1,200 to 2,100 calories per day may be sufficient. The food which supplies this must be carefully chosen and must include foods rich in proteins, minerals and vitamins. It is now believed that many afflictions of old age are caused by malnutrition. The addition of the vitamin B complex in concentrated form may correct digestive disorders and relieve other ill-defined aches and pains—in fact, retard some of the signs of senility. The exact vitamin requirements of older people have not been determined, but they probably vary with the individual and may be even greater than in earlier years. Thus the limited amount of food usually eaten frequently results in protein, vitamin and mineral deficiencies.

The food habits of older people do not always fall in line with their food needs. Many of them develop a craving for sweets and seldom make the necessary compensation in the choice of other foods to provide the essential amount of B complex vitamins to take care of the extra carbohydrate. Sometimes the difficulties of marketing and food preparation prompt a simplification of meals with the omission of fresh fruits and vegetables. This tendency was disclosed by a survey made of the food habits of families in Baltimore in 1943.[4] Records were kept of the amount and the frequency of use of certain foods during one week and the 943 families in the survey were divided according to the age of the homemaker. The ratings of the food habits shown in Figure 48 indicate that by far the largest number of unsatisfactory diets were found in the homes where the homemaker was over 60 years of age. When the types of foods omitted were studied, it proved to be the green and the yellow vegetables, fruits and milk that were most often inadequate (Fig. 49).

Thus it would appear that the emphasis put upon diet in the practice of geriatrics (the diseases of old age) is entirely justified. Tuohy[5] urges, without commending overindulgence, "freer diets and less fear of food." He also presents evidence in the same article that thiamine has a specific action, through its function in connection with carbohydrate metabolism, in restoring muscular adequacy to the gastro-intestinal tract. This advice is in line with the recommendations of Whitney[6] regarding thiamine in chronic constipation. The place of vitamin concentrates in the regime for older people is discussed in the following section.

THE USE OF VITAMIN CONCENTRATES

Unfortunately, very little is known as to the vitamin requirements of older people or as to whether these requirements change with the years and with chronic diseases associated with age. Reports in the medical literature have been both enlightening and discouraging regarding the use of massive doses of vitamins for certain conditions. However, there is much to be learned about vitamins and their rightful place in the treatment and the prevention of chronic disease. It is well to be open-minded, yet not too enthusiastic, on the subject of vitamin therapy.

The evidence from experiments on active men (see Chap. 12) would indicate that when the diet is adequate in all known nutrients, the addition of concentrates does not show any beneficial effect. With sedentary people and older people who are not eating as much food as those who are

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[4] Downes, J., and A. Baranovsky: Milbank Mem. Fund Quart. **23**:161, 1944.

[5] Tuohy, E. L.: J.A.M.A. **114**:223, 1940.

[6] Whitney, E. T.: Bull. New England M Center **6**:170, 1944.

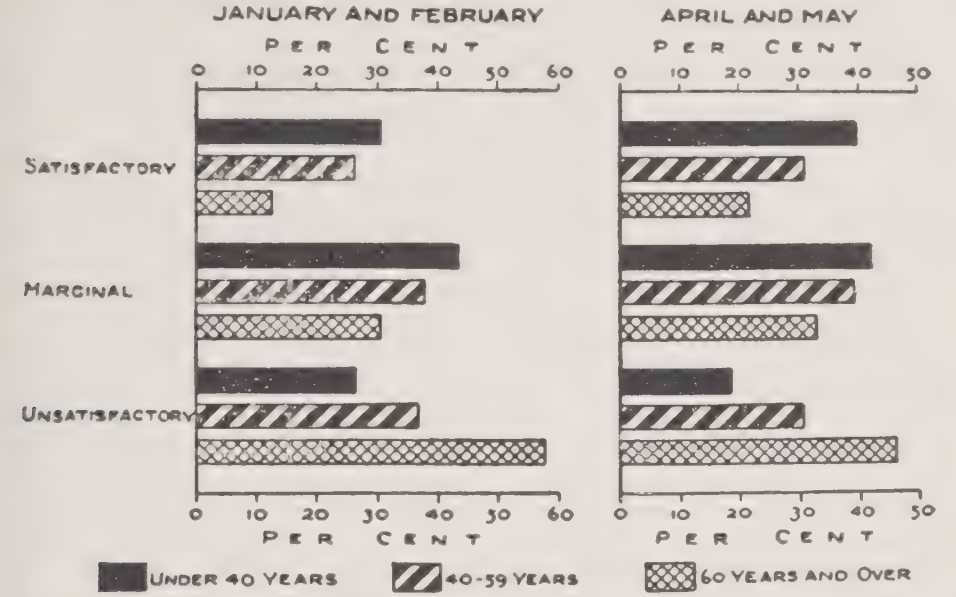

FIG. 48. Food habits in relation to age of homemaker. (Percentage distribution of composite ratings.)

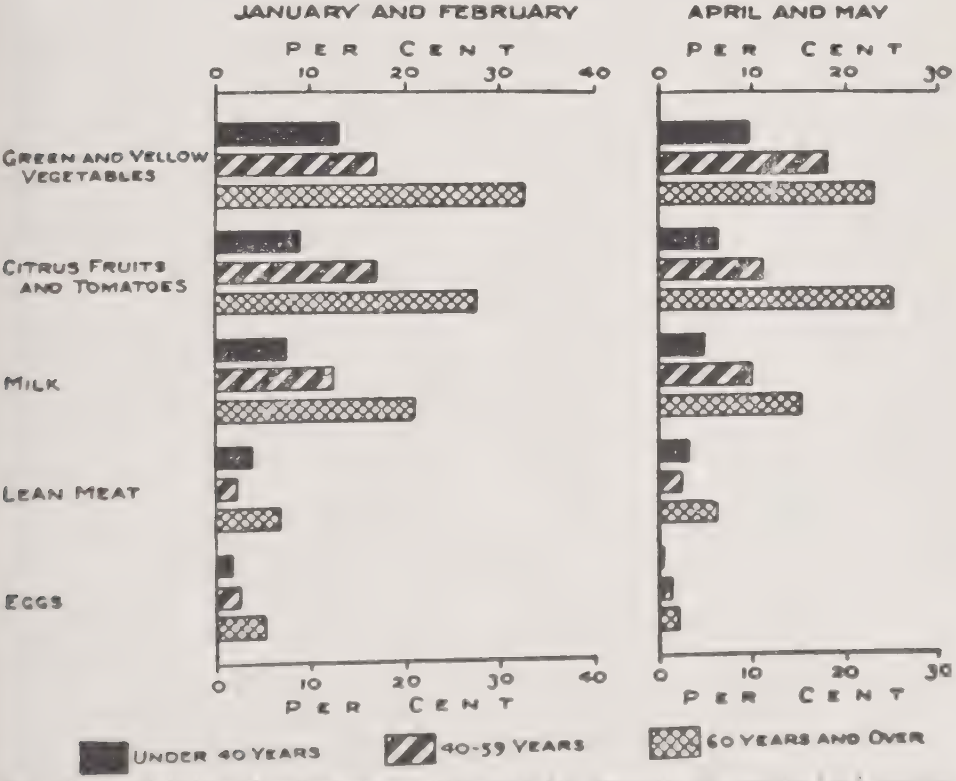

FIG. 49. Food habits classified as unsatisfactory for amounts of specific food groups according to age of homemaker. (Percentage distribution.)

active it is often more difficult to provide the requisite amounts of protective factors without resorting to supplementation with concentrates. This should be done, however, upon the advice of a physician or dietitian and after calculation of what the usual diet provides and what specific needs are indicated.

When people buy and take all types of vitamin concentrates without scientific advice and regardless either of what ails them or of the natural vitamins present in their daily diets, it takes on the earmarks of a fad. Vitamins from the grocer are usually cheaper than from the druggist, and they come in Nature's packages done up with other valuable food constituents instead of alone and labeled in units. But when dietary restrictions, common indeed among adults, make it difficult or impossible to obtain enough of certain vitamins in natural foods, vitamin concentrates have a rightful place. They are put up by several reputable pharmaceutic houses and labeled according to the amount of each vitamin present in milligrams, micrograms or International Units per tablet, capsule or measure. The law is strict in holding the manufacturer to these figures on the label.

FOOD FADS AND FALLACIES

The futile efforts that are often made by those suffering from chronic ailments to improve the state of affairs by pseudoscientific devices reflect an interest and a striving for something better in terms of health. The human psychology that afforded a profitable outlet for the patent-medicine quack a generation ago has offered an equally profitable one for the food faddist in more recent years. Yet such a nutrition-conscious public is just as fertile a field for constructive scientific education. However, it is easy to listen to misleading radio advertising, to read unreliable health literature, to follow suggestions of neighbors or friends and to be misguided by ideas with a plausible sound instead of asking advice of medical and nutrition authorities. Some food fads in themselves may be relatively harmless, but when they lead to delay in seeking necessary medical advice they can be dangerous indeed. In any event, food fads may increase food costs unduly and result in the omission of foods really needed.

Professional people in general have been prone to condemn this interest in dietary and food fads without qualification. Perhaps it should be diverted into profitable and beneficial channels rather than stifled. Suitable literature in doctors' offices and in public libraries and popular nutrition classes and lectures given by qualified physicians and nutritionists may help to guide this interest. Perhaps the professional group have not given the layman what he wants and so he turns to quack health lectures and literature in an effort to "do something about his health."

The commercial advertising of food products is less objectionable now than it was a decade ago. Perhaps some of the adverse publicity and complaints have had an effect. There are still some candies and other sweets that expound the idea of "health and vitality" through "cheap, quick energy." These advertisements are frequently addressed to young people who have only a few nickels to spend for their lunch and want the most for their money. Some time ago there was a candy bar which bore the undernoted legend on the label—every word true but leaving a false impression on a hungry child:

Vitamin Energy Bar (5 cents)
equivalent to

3 loaves of bread	in fat
1 lb. butter	in protein
2½ lbs. cheese	in carbohydrate
2 bunches celery	in calories
2 oranges	in calcium
1 egg	in phosphorus
4 qts. milk	in iron

The comparison in each case is made with a food low in that particular nutrient. Value really is just another candy bar.

There are many "diets" or dietary fads which may be harmless though senseless. For instance, the virtues of an exclusively raw-food diet are expounded by some. These addicts have no use for a stove; they just crunch raw vegetables, fruits and nuts, and perhaps drink a little milk. They may be able to survive and prosper, but why do it? Cooking adds variety in flavor and in texture, and makes many foods edible which could not be used raw. To be sure, some raw fruits or vegetables in the menu are to be recommended as a source of vitamin C, which is reduced by cooking, but that does not mean that we must eat *all* our foods raw; in fact, some digestive tracts would be unable to cope with large masses of raw cellulose.

So-called natural foods are quite apt to be recommended along with raw foods: raw in place of refined sugar, sea salt in place of table salt, olive oil in place of other fat, lemon juice in place of vinegar. Except for price, there is no particular objection to these, but neither is there anything poisonous or harmful in the foods for which they are substituted. Certain vegetable juices have been accredited with more virtues than they actually possess. An increased consumption of vegetables, to be sure, is advised by nutritionists, but what possible foundation can there be for such claims as: Celery juice for indigestion and rheumatism, carrot juice for the complexion, parsley juice as a building tonic, garlic juice for high blood pressure, cabbage juice for the kidneys, white radish and lemon juice for the gallbladder?

Special food combinations are "prescribed" in certain systems of eating. He who dares to indulge in protein and starches or perhaps starches and acid fruits at the same meal faces dire consequences, we are told. But there is no physiologic basis for the notion that the normal human digestive apparatus is not equipped to deal with these foods, whether eaten individually or together. Most natural foods are combinations whether we will or no; even the diet faddists cannot avoid them, but they neglect to tell their patients so.

One of the authors has written several articles on food fads and fallacies and in one article[7] sounds the following caution and adds advice on how to protect ourselves:

"Earmarks of quackery and misleading propaganda should be familiar to the layman. Extravagant claims for cure or relief of various complaints are always to be doubted. Vague labeling which offers no figures or exact information to live up to is one way by which these promoters have avoided the teeth of the law. Labels are never so extravagant as detached advertisements or literature because the laws are stricter about labels.

"Promoters of most of the fad diet systems or health institutes have personality, poise and persuasion. They are convincing speakers with a smattering of scientific knowledge which lends an air of plausibility to their discourse. They mix the true and the false or misleading to suit their needs, to sell their products or to scare their victims into spending money for a course of lectures to cure them of imaginary ills. They use scientific words and phrases to cover false ideas. They accomplish most by personal appearances, but they also work through the mails, the radio, the newspapers, handbills and newsstand publications.

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[7] Mitchell, H. S.: J. Am. Dietet. A. 17:667, 1941.

"Your interests are safeguarded by such agencies as the United States Food and Drug Administration, the Federal Trade Commission, the United States postal authorities, Better Business Bureaus, state and national health associations, and the American Medical Association through its Bureau of Investigation and Council on Foods and Nutrition. But there are ways of evading any law or regulation. There will always be quacks and promoters who want to sell something. There will always be enthusiasts who want you to try their suggestions. Your best protection, after all, is education in the simple principles of nutrition and intelligent skepticism regarding extravagant new theories. Money spent for better food —more of the protective foods—will go farther toward promoting better health for America than the same amount of money now being spent for pseudohealth and diet fads."

REVIEW QUESTIONS

1. The "nutritional improvement of life" is strongly advocated by such leaders as Sherman. What evidence is there that there is room for improvement?

2. At the present time more than half the population of the United States is over 20 years of age. What advances in the health sciences are chiefly responsible for the rapid increase in life expectancy in this century?

3. Control of weight is a problem for many middle-aged men and women. What nutrients are likely to be deficient in quantity when uninformed people cut calories without guidance?

4. What evidence is there that the food habits of older people may be faulty? What foods are they likely to omit and what are some logical reasons why this often happens?

5. The use of vitamin concentrates has been condemned by some, encouraged by others. In what circumstances do they have a rightful place?

6. What food fads have you ever heard discussed or seen practiced? How would you help a layman to distinguish between fact and fad, or between true and false ideas about food?

Part Two

DIET IN DISEASE

INTRODUCTION

Good dyet is a perfect way of curing:
And worthy much regard and health assuring:
A King that cannot rule him by his dyet,
Will hardly rule his Realme in peace and quiet.

The above quotation, taken from an old Latin book on medicine, "Regimen Sanitatis Salernitatum," and written about A.D. 1000, expresses an appreciation of diet in the treatment of disease. The ancients wrote the preview, as it were, to dietetics by their acute observations with little but experience to guide them in their judgments. Hippocrates, about 400 B.C., forecast calorimetry when he wrote: "Growing bodies have the most innate heat; they therefore require the most food for otherwise their bodies waste. In old people the heat is feeble and they require little fuel, as it were, to the flame, for it would be extinguished by much."

Artaeus, a Roman physician of about A.D. 200, described and gave the name to diabetes. He wrote that "diabetes is a rather wonderful but fortunately rather rare disease. It consists of a liquefaction of the flesh and bones into urine. . . . It is just as though the aqueducts were open wide." He further stated his belief that a drug would be found to cure it by controlling thirst. It would seem that the discovery of insulin, discussed in the chapter on diabetes mellitus, fulfilled his prophecy.

How surprised the sailors of old must have been when, after centuries of fear and dread of scurvy, they were able to return from their long voyages well and happy by the simple use of lemons! This was a forerunner of the discovery of vitamin C which we now know exists in many natural foods. Byrd's expeditions to the South Pole would have been impossible had not the dietary needs, especially sources of vitamin C, been planned in advance. The story of the cure of other deficiency diseases is quite as interesting as that of scurvy.

We are now living in a period of medical and nutritional research, the results of which have brought relief to untold numbers of persons and have lengthened the average span of life by many years. Indeed a medical authority [1] recently said, "The prevention and proper treatment of the nutritional diseases constitute one of the greatest medical problems in this country today."

In Part Two will be found an application of the principles of nutrition to the treatment of disease in ways of which the ancients could not have dreamed, since most of the information has been forthcoming within the last twenty-five years.

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[1] Sebrell, W. H.: J.A.M.A. **115**:851, 1940.

19

Therapeutic Diets as Modifications of the Normal

Chapter Topics

GENERAL DISCUSSION
  OBJECTIVES OF DIETARY TREATMENT
MODIFICATIONS
  CONSISTENCY
  CALORIC VALUE
  SPECIFIC NUTRIENTS
HOSPITAL STANDARD DIETS
  GENERAL DIET
HOSPITAL STANDARD DIETS (CONT.)
  LIGHT OR CONVALESCENT DIETS
  SOFT DIET
  LIQUID DIET
  SUPPLEMENTS
  EMERGENCY FEEDING
THE PSYCHOLOGIC FACTOR IN FEEDING PEOPLE

GENERAL DISCUSSION

A careful review of Chapter 1 will afford a historical basis for the application of dietetics to the treatment of disease. The normal diet supplying all of the essentials of an adequate diet is the basis of therapeutic diets. The present chapter shows how these modifications may be made, including also the so-called hospital or standardized diets.

That good food is essential to health is a fact that is generally accepted, but it is rarely recognized how frequently the poor selection of food may be a contributing factor to disease. On the other hand, the intelligent use of food in the treatment of disease has become a matter of special interest to the medical and the nursing professions, as well as to dietitians specially trained in the subject. Furthermore, the wide interest evident among the laity in diet fads and diet cures makes it necessary for the professional dietary treatment of disease to be sane and scientifically sound. Many of the dietary regimens published have some basis of truth in them but much that is false. The physician, the dietitian and the nurse must be able to read these critically.

A well-balanced diet, capable of maintaining good nutrition, such as has been discussed in previous chapters, is the basic principle for all dietary prescriptions. Modifications of this general diet can then be made to suit the various needs of the body in disease. Many times this can be done by making one or two changes in the regular house diet.

Objectives of Dietary Treatment

The objectives of dietary treatment are one or more of the following:

1. To increase or decrease body weight.
2. To rest a particular organ, as when fat is reduced in diseases of the liver.

3. To adjust the diet to the ability of the body to metabolize certain food constituents, as in diabetes mellitus.
4. To overcome deficiency states by the addition of foods rich in an essential element or food constituent, as, for example, vitamin C in scurvy.
5. To provide so-called ease of digestion by exclusion or removal of irritating substances or those which delay the emptying time of the stomach, such as fiber, condiments and fried foods. This may be accomplished by a liquid, soft or bland diet.

MODIFICATIONS

Keeping in mind that the diet must be nutritionally adequate (except for short periods), modifications may be made in consistency, in total caloric value or in the individual nutrients.

Modifications in consistency may be made by the use of the following diets:

1. Light or convalescent diet.
2. Soft diet.
3. Liquid or semiliquid diet. (These diets are described later in this chapter.)

The total caloric value may be increased or decreased as indicated below:

1. **Increase in total energy** value is needed by patients who are for any cause malnourished or underweight. Extra calories are also required by persons convalescing from an acute illness, or having a high basal metabolism; by pregnant women and nursing mothers. Children also must be given more calories per unit of weight than adults.
2. **Decrease in total calories** is desirable when the patient is overweight or has a low basal metabolism.

Variations in the balance of nutrients may be made to meet a number of conditions.

1. **Protein:**
    - (a) **Liberal allowance** is required during fevers, in tuberculosis and other wasting diseases; in peptic ulcers, liver and kidney diseases and anemia, and during growth, pregnancy and lactation.
    - (b) **Limited amount** is sometimes advocated in certain kidney diseases.
2. **Fats:**
    - (a) **Fats may be increased** in the diet when underweight or malnutrition exists, as in convalescence.
    - (b) **Low fat diet** is prescribed in diseases of the liver, in some gallbladder disturbances and in obesity.
3. **Carbohydrates:**
    - (a) **Starches and sugars** make up a large percentage of the normal diet, but these may be further increased when a high caloric diet is desirable; in diseases of the liver and the gallbladder; in hyperthyroidism; in nephritis and in uremic conditions.
    - (b) **Both starches and sugars are carefully restricted** in diabetes mellitus and are reduced in cases of obesity.
4. **Purines** or purine derivatives: These are usually restricted in gout.

5. Minerals:
    - (a) **Common salt** (sodium chloride) is increased in Addison's disease but restricted in cardiac conditions and in diseases of the liver and the kidneys, when accompanied by edema.
    - (b) **Calcium and phosphorus are increased** in rickets, osteomalacia, tetany and dental caries. Low calcium diet is given in lead poisoning.
    - (c) **Iron is increased** in nutritional and in hemorrhagic anemia, and sometimes in pernicious anemia.
    - (d) **Acid and basic elements** in foods must sometimes be carefully calculated to ensure a predominance of either the basic or the acid elements.
6. **Vitamins:** Specific vitamins must be increased in the treatment of vitamin-deficiency diseases and in certain other conditions.
    - (a) **Vitamin A**—In xerophthalmia and night blindness, and certain urinary infections.
    - (b) **Thiamine**—In beriberi, neuritis, constipation, heart disease, pellagra.
    - (c) **Niacin**—In pellagra.
    - (d) **Riboflavin**—In certain eye conditions, pellagra.
    - (e) **Ascorbic Acid**—In scurvy, ulcer, wound healing and certain infections.
    - (f) **Vitamin D**—In rickets and osteomalacia.
    - (g) **Vitamin K**—In certain hemorrhagic conditions.
7. **Water Content:** Fluids may be "forced," as in certain types of infections, and they may be restricted when so ordered, as in edema of nephritis or cardiac disease.
8. **Roughage** and bulk:
    - (a) **Little or no fiber** should be given in typhoid fever, in ulceration of any part of the alimentary tract or immediately following operations upon the gastrointestinal tract.
    - (b) **Liberal amount of fiber** is prescribed in the treatment of atonic constipation.
9. **Specific articles of food** may have to be omitted when an individual is found to react unfavorably to them. This is known as food allergy.

The above outline shows how modifications may be made from the normal diet to meet special needs in the case of disease. The reasons for these adaptations will be given in the following chapters.

HOSPITAL STANDARD DIETS

The simplest modifications of the normal diet from the standpoint of nutritional requirements and also the preparation and the serving of the food are the standard hospital diets, sometimes known as type diets. These may be prepared in bulk in much the same way as the general or full diet.

General Diet

This diet is known by a number of names, such as house, regular, or full. It provides a greater variety and fewer restrictions than other standard or routine diets. It is intended for ambulatory patients and for those whose condition does not require a special or a therapeutic diet.

In order that hospital diets, including special diets, may be adequate, a basic pattern which will provide all the nutrients in the amounts recommended by the National Research Council has been worked out. It is shown below. The "basic-7" foods constitute the basis of the dietary pattern given below, and it is similar to the one given in Chapters 11 and 12. While the two patterns, one for the well person, the other for the sick, are basically the same, it is evident of course that modifications must be made for the sick. For example, legumes as a source of protein are rarely served in place of meat; neither are certain vegetables such as onions, turnips and others, which may form gas during digestion. (See Chap. 47.) Pork, even though nutritionally superior to the other meats, is more difficult to digest because of the larger amount of fat, and it is therefore usually omitted from the house diet. Great care must be taken in the preparation of the patient's food. Fried foods and rich pastries are usually omitted from hospital menus because these are not easily digested. (See Chap. 4.)

The table of foods on next page constitutes the basic pattern on which the general hospital diet should be planned, and it should also be used as far as possible as the foundation for all other therapeutic diets, except those used in emergencies or for short periods of time. If for any reason the diet is lacking in any of these essential groups, the inadequacy should be noted and, if possible, supplemented by foods or, if necessary, by vitamin or other medicinal supplements.

It will be noted that the basic dietary pattern on next page furnishes all the nutrients recommended by the National Research Council, except calories. It is assumed that when the menu or the special diet is planned, "other foods" as desired and as indicated by the specific requirements of the patient may be added. For example, cream and sugar may be served with the breakfast cereal, and coffee or other beverages may be served with the three meals, either with or without sugar and cream. Jelly with the toast may add pleasure to the meal as well as additional calories and some of the minerals. Soup and crackers are desirable additions. Two additional vegetables may be added, one of them raw if the patient's condition permits. If not, additional citrus fruit, such as orange or other fruit juice, is desirable. Desserts also furnish not only calories but other important nutrients as well.

In some hospitals slight modifications in this general diet may be made: for a high caloric general diet the so-called high caloric additions are made to it at mealtime or between meals as "nourishment."

Typical menus for the regular house diet, built upon the above basic dietary pattern, appear along with other standard diets later in the chapter.

Light or Convalescent Diets

A light or convalescent diet is, as indicated, intended for convalescent patients not yet able to take the regular diet and for those with minor illnesses. It must be appetizing and readily digested. The chief difference between this diet and the regular house diet is the method of preparation. The foods are plainly cooked—no fried foods or rich pastries are served. Other fat-rich foods such as pork (except bacon) and salad dress-

BASIC DIETARY PATTERN APPLIED TO THERAPEUTIC DIETS

Food	Measure	Weight Gm.	Prot. Gm.	Fat Gm.	Carb. Gm.	Calories	Ca Gm.	Fe mg.	Vitamins				
									A I.U.	Thiamine mgm.	Riboflavin mgm.	Niacin mg.	Ascorbic Acid mg.
Milk	1 pint	480	17	19	24	331	.56	.5	770	200	820	.5	5
Meat, med.-fat, med. done	1 serving	100	27	18	...	213	.01	4.1	20	120	200	5.2	...
Egg	1	50	7	6	...	79	.03	1.4	570	60	170	...	...
Additional protein	1	...	7	7	3	103	.13	0.8	500	70	200	.6	1
Fruit, citrus	1 serving	100	1	...	11	48	.02	.4	180	70	30	.2	42
Other	1 serving	100	1	...	15	64	.01	.6	930	40	40	.3	15
Vegetables, green or yellow	1 serving	100	3	...	10	52	.05	1.3	4,410	90	140	.7	27
Other	1 serving	100	1	...	9	40	.03	.4	40	30	30	.2	14
Potato	1 small	100	2	...	19	85	.01	.7	20	110	40	1.2	17
Bread, whole grain, or enriched	3 slices	90	9	3	43	236	.05	2.3	...	250	140	3.1	..
Cereal, whole grain or enriched	1 serving	20	3	1	15	80	.01	.6		60	40	.6	
Butter or margarine	3 pats	30		24		220	.	. .	990		.		
Total			78	78	149	1,551	.91	13.1	8,430	1,100	1,850	13.2	121
Recommended allowances National Research Council													
Sedentary man			70			2,500	.80	12.0	5,000	1,200	1,600	12.0	75
Sedentary woman			60			2,100	.80	12.0	5,000	1,100	1,500	11.0	70

[1] The values given above were obtained by the group method, such as given by Donelson and Leichsenring in J. Am. Dietet. A. (See Part Four, Table 2) July 1945. For example, "Other fruit" is an average of the five listings other than citrus, under the subject of fruits; vegetables "green or yellow" are an average of the seven items listed under the term "green and yellow" vegetables.

[2] "Additional protein" is an average of 1 ounce of meat, 1 ounce of cheese, 1 egg and 1 glass of milk.

[3] "Meat" is the average for meat and poultry, cooked medium fat and medium done, as given in circular 549 U. S. Department of Agriculture, 1940.

[4] Deductions of 50 per cent were made for ascorbic acid, thiamine for canned and cooked vegetables. Deductions were also made for calcium in spinach, beet greens and chard, as these are "unavailable" due to the oxalates present.

ings are avoided. Bran and coarse vegetables are avoided; also raw vegetables and fruits, except the citrus fruits. All foods included in the soft and the liquid diets may be served in the light diet. In some hospitals this classification is omitted.

SOFT DIET

As the name would indicate, this diet is soft in texture and consists of liquids and semisolid foods. It is an intermediate step between the light and the liquid diets. It is indicated in certain postoperative cases, in acute infections and in some gastro-intestinal conditions.

It is low in residue and is readily digested. Little or no spices or condiments are used in the preparation. The same restrictions cited for the light diet apply to this one also. The soft diet is further restricted since only puréed vegetables are served and meats are limited to tender chicken, fish, scraped beef and sweetbreads. In some hospitals no meat is allowed in this diet.

LIQUID DIET

Foods in the liquid state are more easily digested because they are so finely divided. In many acute conditions there is need for foods which will digest readily (see Chap. 10). The lightest of foods are given—broths, albumin drinks, thin gruels and fruit juices, or lemonade, tea and coffee if

TABLE OF FOODS ALLOWED IN STANDARD HOSPITAL DIETS

Type of Food	Full Diet	Light Diet	Soft Diet	Liquid Diet
Fruits	All	All cooked fruits and citrus fruits	Fruit juices, cooked fruits (without seeds, coarse skins or fiber)	Fruit juices, strained
Cereal and cereal products	All	Cereals: well cooked and prepared; spaghetti, macaroni, plain cooked	Fine grain or strained whole grain cereals. Light diet minus prepared cereals (these are sometimes allowed)	Gruels, strained
Breads	All	Enriched and whole-wheat bread, soda crackers	Bread, enriched and whole-wheat, and soda crackers	
Soups and broths	All	All	Clear broth, beef tea, strained soups	Same as Soft Diet
Meat, fish and poultry	All	Steaks, chops, bacon, chicken, sweetbreads, scraped beef, liver, fish	Tender chicken, fish, sweetbreads and scraped beef	
Eggs	Eggs cooked in all ways	Soft-cooked eggs	Same as Light Diet	Eggnogs
Dairy products	Milk, sweet and acid; cream; butter; cheese—all kinds	Milk, sweet and acid; cream; butter; cheese—cottage, cream	Milk, sweet and acid; cream; butter; cottage cheese; cream cheese	Milk, sweet and acid; cream
Vegetables	All, including salads	Cooked vegetables: asparagus, peas, string beans, spinach, carrots, beets, squash	Cooked vegetables (puréed): same as Light Diet	
		Salads: tomato and lettuce		
		Potatoes: boiled, mashed, creamed, scalloped, baked	Same as Light Diet	
Desserts	All	Ices, ice cream, junket, cereal puddings, custard and gelatin, simple cakes, plain cookies	Same as Light Diet	Ices, ice cream, gelatin, junket and custard
Beverages	All	Tea, coffee, cocoa; coffee substitutes and milk beverages	Same as Light Diet	Same as Light Diet

TYPICAL MENUS FOR STANDARD HOSPITAL DIETS

Full Diet	Light Diet	Soft Diet	Liquid Diet
Breakfast			
Fresh pear	Orange	Orange juice	Orange juice, strained
Oatmeal with milk or cream	Oatmeal with milk and cream	Oatmeal with milk and cream	Strained oatmeal gruel with milk or cream
Scrambled eggs	Soft scrambled eggs	Soft-cooked eggs	
Buttered toast	Buttered toast	Buttered toast	
Coffee with cream and sugar	Coffee with cream and sugar	Coffee with cream and sugar	Coffee with cream and sugar
			10 *A.M.*
Lunch			Eggnog
Vegetable soup	Strained vegetable soup	Strained vegetable soup	Strained soup with Farina
Roast veal	Veal chop	Scraped beef, boiled	Milk and cream
Mashed potatoes	Mashed potatoes	Mashed potatoes	
Carrots, buttered	Carrots, buttered	Carrots, puréed	
Tomato salad with dressing			
Bread, whole-wheat, rye or white	Bread, white	Bread, white	
Butter	Butter	Butter	
Ice cream	Ice cream	Ice cream	Ice cream
Milk	Milk	Milk	Coffee with cream and sugar
			3 *P.M.*
Dinner			Malted milk or buttermilk
Cream of pea soup with crackers	Cream of pea soup with crackers	Cream of pea soup, strained	Cream of pea soup, strained
Macaroni au gratin	Cream cheese and lettuce salad	Cream cheese	
Lettuce with mayonnaise			
Bread	Bread, white	Bread, white	
Butter	Butter	Butter	
Fruit gelatin	Fruit gelatin	Plain gelatin with whipped cream	Plain gelatin with whipped cream
Coffee or tea with cream and sugar	Coffee or tea with cream and sugar	Coffee or tea with cream and sugar	Coffee or tea with cream and sugar
			10 *P.M.*
			Hot cocoa

the patient is accustomed to them. For postoperative liquid diets see Chapter 34. The liquid diet is also prescribed in acute infections and in inflammatory conditions of the gastrointestinal tract. In prolonged fevers, however, it may be necessary to give the largest amount of food possible in the most easily digested form. If high nutritive value is desired, milk in some form usually is the basis of the diet. Cream may be added in order to increase the caloric value. Buttermilk or any one of the sour-milk preparations, peptonized milk or boiled milk may be used to suit the digestive ability and the taste of the patient. Lactose or corn sirup may be added to give additional calories. High protein feedings can also be given (see Chap. 43). By careful planning the diet may be increased in caloric value to approach the normal, as in the diet in the case of typhoid fever and in the Sippy and certain postoperative diets. Plain ice cream, fruit ices, junket and plain gelatin desserts are allowed as convalescence proceeds. It is important that in the liquid diet, feedings consisting of 6 to 8 ounces should be given every 2 or 3 hours.

An outline of foods included in hospital standard diets is given on previous page. A comparison of these diets will show how an acutely ill patient may progress from the liquid to the soft, to the light and on to the general or house diet. Typical menus are also given. There is some difference in the practice of various hospitals as to what is included in these standard diets, and the nurse should become thoroughly familiar with the meaning of the terms in the hospital in which she is located.

Supplements

Research in the nutritional aspects of therapeutic diets has only recently been undertaken, but the results clearly indicate need for evaluation of these diets for other nutrients than just those of the energy-producing group. Spies [1] suggests checking all therapeutic diets with what is required for an adequate diet and further recommends that if the restrictions are of such a nature that the foods permitted cannot provide the essential nutrients in adequate amounts, these nutrients be supplied by supplements in the form of concentrates or synthetics. These of course can be determined by the physician only. Although the physician may supplement the diet when deficiency conditions exist or when necessary restrictions are imposed, it should not be overlooked by the one who writes the dietary menus that every effort must be made to make the diet as adequate as possible.

Spies [2] also calls attention to the per cent of deficiencies in food nutrients which he observed among a large group of patients.

Joliffe [3] also emphasizes the fact that vitamin supplements are indicated as follows:

1. For the general population that will not or cannot eat a satisfactory diet, or for those whose diets do not appear to be satisfactory; for those on restricted diets, as in obesity, diabetes, gallbladder disease, peptic ulcer and food allergy or during illness, infections or some surgical conditions and in convalescence; for those on special diets for food faddists; and for infant feedings.
2. For persons known to have an increased vitamin requirement, as in hyperthyroidism, pregnancy, lactation, fevers and delirium or during periods of unusual physical exertion.

Emergency Feeding

In many emergencies such as follow abdominal operations, accidents and the inability to swallow, the patient must be kept nourished. In such cases feeding by tube is resorted to, as described in the chapter on preoperative and postoperative diets. The giving of blood transfusions is another way of providing nourishment to those who are unable to take food by mouth and the intravenous administration of protein hydrolysates and glucose still another. See also chapter on preoperative and postoperative diets.

THE PSYCHOLOGIC FACTOR IN FEEDING PEOPLE

The diet may be properly prescribed, prepared and served, but if the patient cannot be persuaded to eat the food little good will be accomplished. Sick people are hard to please and the nurse or attendant must apply all the psychology at her command to overcome preconceived prejudices and false notions and, most difficult of all, meet with sound argument the pseudoscientific reasoning of the neurasthenic who has "made a study of his own case" and thinks he knows best. There are other patients who present an entirely different problem; they have little or no appetite and may or may not understand the necessity of eating. In such cases an extra effort should be made to tempt their appetites and persuade them to eat. The nurse or the dietitian will always find that an agreeable approach will work wonders with difficult patients.

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[1] Spies, T.: J.A.M.A. **122**:501, 1943.

[2] *Ibid.*

[3] Joliffe, Norman: J.A.M.A. **129**:613, 1945.

It may seem from the preceding paragraphs and the chapters to follow that a dietary regimen for a particular disease or condition can be planned and prescribed for the average case and applied to all cases thus affected. On the contrary, every patient is an individual with likes and dislikes, peculiar complications, special needs and variations in ability to utilize certain foods; and the diet prescription must take this into consideration. We therefore make a plea, not for uniform, wholesale diet prescriptions or hard-and-fast rules, but for a psychologic understanding of and a sympathetic approach toward the patient, and also for scientific consideration of the disease and its complications.

It must not be forgotten that the appearance of the food and the tray may also produce a psychologic effect which may determine acceptance or rejection of the meal.

The economic factor is also a matter for consideration, especially when a patient is being cared for in the home. For a discussion of this and other home problems see Chapters 11 and 12.

REVIEW QUESTIONS

1. Illustrate the use of each one of the objectives of dietary treatment with patients you have observed.
2. Illustrate the use of each one of the ways in which diets may be modified by patients you have observed.
3. What is the basic dietary pattern for planning the hospital standard diets?
4. How do each one of the standard hospital diets differ from each other and from the regular diet of well people?
5. Using the basic dietary pattern as a guide, plan a day's menu for yourself, giving the specific foods included in each of the groups listed, also the additional foods necessary to supply the required calories. Plan a similar menu for a patient on a general or house diet, also one on a soft diet. Evaluate all three menus.
6. What psychologic factors should be kept in mind in the feeding of patients?

20

Overweight and Underweight

Chapter Topics

LIFE EXPECTANCY AND BODY WEIGHT
OBESITY
  EXERCISE AND WEIGHT
  DRUGS AND WEIGHT
OBESITY (CONT.)
  DIETARY CONTROL OF WEIGHT
    REDUCING DIET
UNDERWEIGHT
  DIET FOR UNDERWEIGHT

LIFE EXPECTANCY AND BODY WEIGHT

The question of body weight is of general interest today. Standards on this matter have changed greatly in the past generation for two significant reasons: the first reason, and that which influences many people, is the fact that fashion has decreed the slender figure; the second reason, based on scientific observation, is that studies of a large number of persons made by life-insurance companies have shown that life expectancy is influenced to a large extent by body weight.

The recent effort to avoid overweight which has become general has had both good and bad results. It has in many cases led to better food selection and to making exercise a regular part of the health program. At the same time, harm has often resulted when food has been cut to a low level by indiscriminate dieting. This is especially true of those under 30 years of age. In general, the physical condition will probably be better if weight is kept above average before the age of 30 and under average after 40 years. These conclusions have been drawn largely from statistical studies made by life-insurance companies that involved many thousands of their policy holders. As a further result of these studies, tables of average heights and weights have been in general use as a means of determining normal weight for specified heights. These tables are to be found in Part Four, Table 12.

More recently, emphasis has been put upon the relation of body build to body weight. This is determined by the taking of several body measurements by which the body frame is designated as small, medium or large. These tables have been designated as ideal weights, and are now used in many institutions and by many doctors. These ideal-weight tables for men and women are also found in Part Four, Table 12.

OBESITY

Prognosis. Obesity is defined as an abnormal condition due to excessive deposits of fat in the body resulting in overweight. In diagnosing obesity, allowance must be made for differences in body build and hereditary factors, as already stated. Evans[1] reiterates the statement that "the ideal weight should at no age be considered greater than that for a normally built person of the same height and sex at age 30 to 35." He further adds that a "maximum allowance of 10-per-cent variation over or under ideal weight, depending on body build, is permissible for a very few patients. If these criteria are not fulfilled, the storage in the body for inert fat is present—the subject is obese." Obesity is detrimental to the health of the individual. It overburdens such organs as the heart and the circulatory system, the liver and the gallbladder, and may be a predisposing factor in diabetes mellitus, gout and arthritic conditions. It also increases the risk of surgery and delivery of obstetric patients.

Types of Obesity. This condition is sometimes classified according to cause as exogenous or endogenous obesity. In the exogenous type the cause is purely an excessive food intake, while the endogenous variety is due to some contributing factor within the body itself, such as a disturbance of function of one or more of the ductless glands, including the thyroid (hypothyroidism), the pituitary (hypopituitarism) or the genital glands. Obesity in adults is usually a result of overindulgence in food and of sedentary habits, and should not be explained and excused by pronouncing these persons victims of glandular deficiencies. Obesity in children and adolescents is, however, frequently of the endogenous type.

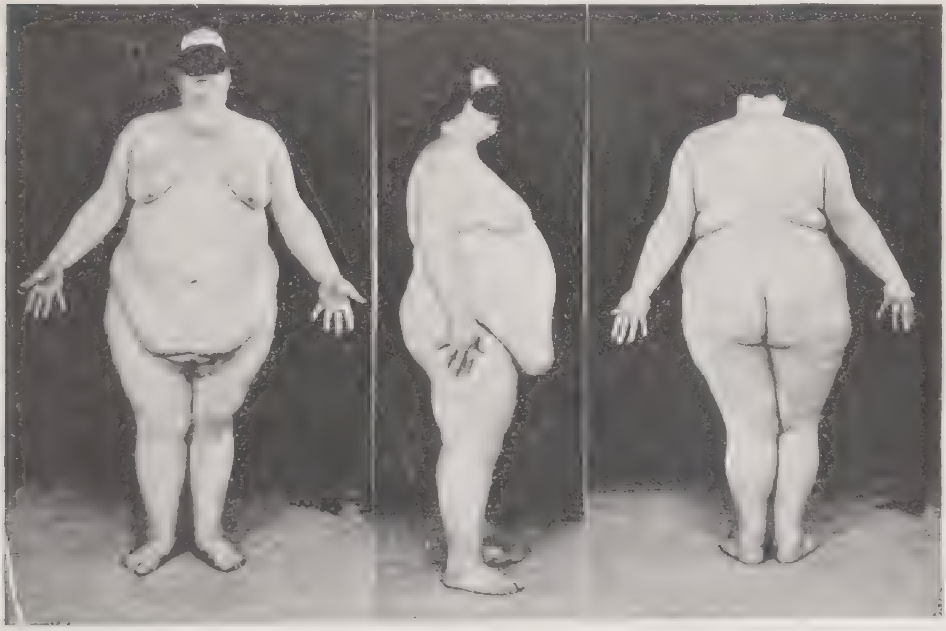

Fig. 50. Pituitary obesity. (Anspach, B. M.: Gynecology, Philadelphia, Lippincott.)

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[1] Evans, F. A.: Duncan's Diseases of Metabolism, Chap. 10, Philadelphia, Saunders, 1942.

EXERCISE AND WEIGHT

Exercise is important, since it increases the oxidation of the fat. Walking is excellent. A 300-pound man, walking 3 miles per hour, will consume about 330 calories, or the equivalent of 1⅓ ounces of body fat (see Chap. 6). Daily gymnastic exercises are also effective. The only drawback about exercising to reduce is that the appetite is increased and, if entirely satisfied, will more than overbalance the calories lost in exercise. Strenuous exercise may be dangerous for the obese, especially if they are past middle life. The type and the amount of exercise should therefore depend upon the age and the specific condition other than the obesity. In cardiovascular diseases exercise must be limited.

DRUGS AND WEIGHT

Drugs or proprietary preparations to decrease the weight should never be taken without the consent and the supervision of the physician.

Several drugs have appeared on the market as weight-reduction products. Among the first ones tried was thyroid extract, which, being a natural or physiologic product, was thought to be safe, but it soon proved to be quite the contrary, except in certain well-controlled situations.

Dinitrophenol, which came into the limelight a few years ago as a weight-reducing drug, has been proven extremely dangerous and sometimes fatal in its effect. It increases the metabolic rate and causes a loss of weight, but it is known to have an insidious and cumulative effect. It causes in some people vague and ill-defined symptoms; in others, a specific injury to the lens of the eye that results in rapid cataract formation. Publicity regarding the dangers accompanying the use of this drug has practically eliminated the sale of this product. Reliable druggists realize the hazards of the promiscuous sale of such a drug and advise against its use.

Benzedrine is also a drug that is sometimes given to impair the appetite and thus reduce the energy intake. This too is a dangerous drug and may be habit-forming.

Common laxative salts sold under a variety of fancy trade names or laxative drugs sold as harmless remedies all accomplish similar results—the loss of large volumes of water through the stools. The sudden weight reduction is due to loss of water, not fat, and both the water and the resulting weight will be regained promptly as soon as water is consumed. Furthermore, permanent injury to the intestine and the digestive function may result from the repeated use of such drastic treatment. Proper laxative agents have their place in medical practice, but not as obesity cures.

DIETARY CONTROL OF WEIGHT

Since adipose tissue is a storage for excess fuel food, the caloric intake must be lowered below the actual daily needs if the body is to draw upon and reduce its reserve supply of body fat. This fuel requirement may be especially low in the endogenous type of obesity, where all the body processes are slower than normal. Body fat is formed chiefly from the carbohydrate and the fat in the food eaten.

Protein is needed at all times for repair of body tissue, but when this demand has been met the remainder is used as a source of energy or heat production. Since protein, due to its specific dynamic action, stimulates more heat production per 100 calories of food consumed than either carbohydrate or fat, it is evident that it should form a relatively large portion of a reducing diet. One gram of protein per kilogram of normal weight, or approximately 70 Gm. of protein per day for adults, has usually been regarded as the normal allowance, but medical men now advocate a higher intake. Wohl[2] reports better results with an intake of 1 to 1.5 Gm. of protein per kilogram of body weight, as this allows for more meat, fish and eggs, all of which have a high satiety value. McLester[3] advises an intake of 1.5 to 1.7 Gm. per kilogram of normal weight.

Carbohydrate should constitute approximately 50 per cent of the total calories allowed, which in a diet of 1,200 calories would be 150 Gm. of carbohydrate. Fat, on the other hand, is the one foodstuff that in obesity can be reduced to a minimum. The body is thus forced to obtain its supply of fat from that stored as adipose tissue.

Precaution should be taken to see that the foods supplying calories contain all the other essentials of a normal diet, such as vitamins, minerals and bulk, in quantities at least equivalent to those of a normal diet, unless the total calories are very low, in which case supplements such as vitamins and mineral concentrates are indicated. Thus fruits, tomatoes and such vegetables as spinach, lettuce, cauliflower, cabbage and asparagus are valuable in planning the reducer's menu, in addition to skim milk, eggs, cheese, fish and lean meat as sources of protein. What fats are used should consist of butter, cream, liver and egg yolks to supply vitamins A and D. Bulk or fiber is obtained from vegetables and fruits, also bran and whole cereals, all of which help to satisfy hunger.

The satiety value of foods must be considered in prescribing a reducing diet. That "all-gone" feeling which is so often experienced when the food intake is limited may be so severe as to cause real discomfort and become a strong temptation to overstep the prescribed diet. The use of bananas in one recommended reducing regimen owes some of its virtue to the slowness with which they leave the stomach. Foods containing fat have good staying qualities, but they are of necessity omitted or greatly reduced and, consequently, any food of lower caloric value which gives satiety value to the meal should be included. Potatoes are also satisfying and may be used in limited amounts as a substitute for bread. Desserts have satiety value, but they should be limited to gelatins with little sugar and to fresh fruits such as apples, peaches, pears, plums or bananas.

Water may be taken in moderation with meals, and more freely between meals, unless restricted because of some heart or kidney complications. Sometimes there is retention of water in the tissues, especially when salt is taken in liberal amounts, which prevents loss of weight.

Fuel Value. In planning a reducing diet, the first consideration should be the determination of the fuel value of a normal diet for the individual based on the normal weight for persons of the same height, age, sex and degree of activity. For adults this will vary from about 2,000 to 3,000 calories for moderate activity. The fuel value in a reducing diet may safely be cut one fourth to one half, although it seldom is advisable to go below 1,200 calories, unless there is very close medical supervision. A reduction in weight of 1½ to 2 pounds per week will usually result from this regimen. This rate of reduction should not be exceeded unless by the advice of the physician. Occasionally a physician may prescribe a diet as low as 800 calories, or even less, when the patient is hospitalized or is under constant observation.

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[2] Wohl, M. G.: Dietotherapy, Philadelphia, Saunders, 1945.

[3] McLester, J. S.: Nutrition and Diet in Health and Disease, ed. 4, Philadelphia, Saunders, 1943.

The following is an outline that may be followed in the planning of these diets:

REDUCING DIET

Reducing or Low Caloric Diet

Characteristics:

1. Low in caloric value—¾ to ½ of normal, possibly lower
2. Low in fat and carbohydrate
3. Normal or high protein, minerals and vitamins

Foods Usually Allowed:

Eggs and dairy products—Eggs in all ways except when fried or otherwise prepared with butter, cream or fat; cheese made of skimmed milk (Swiss and cottage cheese)

Meats, fish and fowl—Lean roast or boiled beef, lean roast or boiled pork, broiled beefsteak, lamb chops—lean meat only; chicken, roast or boiled, turkey—lean meat only; fish, boiled or broiled

Soups—Clear broths and strained soups

Vegetables—all kinds; potatoes may be used once or twice a week

Cereals—In limited amounts, and served with milk—preferably skimmed

Breads—One thin slice only at a meal and this preferably whole-grain or enriched

Fruits—All fresh fruits

Beverages—Buttermilk, skimmed milk, coffee, tea or cereal coffee, all without sugar or cream

Desserts—Fruit, fresh or cooked (unsweetened), gelatin desserts (little or no sugar)

Foods to Be Avoided or Used Sparingly:

Fats—Meat fats, salad dressings, nuts, cream, butter (except ½ square per meal), fried foods and pastries

Sweets—Sugar, candy, jellies, jams, honey, all sweetened fruits and desserts (saccharine may be used in place of sugar, if desired)

Starches—Potatoes and cereals used once or twice a week except when substituted for a slice of bread

The chart on the following page based on the basic dietary pattern of the preceding chapter illustrates how modifications of the diet may be made. It is assumed that the dietary prescription calls for 1,000 calories. By checking with the basic pattern it will be seen that a reduction of 550 calories will have to be made, but in doing so the protein should remain above or near the recommended allowance of 60 to 70 grams. A glance at the calorie column shows that milk, bread, butter and meat are the highest in calories. Furthermore, by referring to Food Table I, Part Four, it will be noted that skimmed milk has approximately half the number of calories, yet contains the same amount of protein. So it would seem advisable to substitute skimmed milk in place of whole milk and thus save 163 calories. Cottage cheese may be substituted for part or all of the skimmed milk.

Butter may be cut to ⅓ ounce (1 pat), thus saving 146 calories, with no reduction in protein. A further reduction may be made by omitting the potato and decreasing the bread or cereal. If the potato is omitted, a saving of 85 calories is affected. Two slices of bread with a caloric value of 157 calories make a total of 551 calories to be deducted from the grand

REDUCING DIET VALUES COMPARED WITH THE BASIC DIETARY PATTERN

Food	Measure	Weight	Prot.	Fat	Carb.	Calories	Ca Gm.	Fe mg.	Vitamins				
									A I.U.	Thiamine mgm.	Riboflavin mg.	Niacin mg.	Ascorbic Acid mg.
Basic pattern			78	78	149	1,551	.91	13.1	8,430	1,100	1,800	13.2	121
FOODS TO BE SUBTRACTED													
Milk	1 pint	480	17	19	24	331	.56	.5	770	200	820	.5	5
Bread	2 slices	60	6	2	29	157	.04	1.6	....	168	90	2.1	..
Butter	2 pats	20	..	16	...	147	..	...	660	....	....	...	...
Potato	1 small	100	2	..	19	85	.01	.7	20	110	40	1.2	17
Values to be subtracted from basic pattern			25	37	72	720	.61	2.8	1,450	478	950	3.8	22
Total after subtraction			53	41	77	831	.30	10.3	6,980	622	900	9.4	99
FOODS TO BE ADDED													
Skimmed milk	1 pint	480	17	..	24	168	.57	...	....	200	820	.5	5
or													
Cottage cheese	½ cup	100		..	.	....	.				. .		. .
Grand total after subtraction and addition			70	41	106	999	.87	10.3	6,980	822	1,720	9.9	104

total of the basic pattern. This, then, leaves the accompanying schedule of foods which may be served. The nutritive values are also given.

By an analysis of these figures it will be seen that the caloric values are as prescribed, which is of chief consideration in a reducing diet. But it will also be observed that the diet is somewhat below the recommended allowances in iron, thiamine and niacin, which illustrates the fact that a diet of such low caloric value should not be continued for any great length of time. Many physicians, however, do supplement the diet by the administration of vitamin concentrates and iron, in which case the diet may be continued for a longer time. Much can be done also in choosing the foods on the daily menu that are especially rich in the deficient nutrients. For example, liver, which is richer in iron and in niacin than other meats, can be served at least once a week as the meat dish, and an additional egg, which is also rich in iron, may be served daily as the "additional protein." The green vegetables are especially high in iron and should be used daily.

Again referring to the reducing diet on page 234 the foods allowed are listed, showing how the general plan or pattern may be carried out.

After the food items have been selected and evaluated, the next step is to divide them into the three meals, such as the following:

BREAKFAST

½ glass orange juice
Whole-wheat cereal
1 glass skimmed milk
1 egg
Coffee

LUNCHEON

Broth, fat-free
3 oz. lean meat
Carrots
½ slice bread
½ pat butter
Tea or coffee

DINNER

Cottage cheese
Sliced tomatoes and cucumbers on lettuce
½ slice bread
½ pat butter
Fresh fruit
1 glass skimmed milk

UNDERWEIGHT

Types of Leanness. As in obesity, the causes of leanness or of underweight may be either exogenous or endogenous, the exogenous being due to an inadequate diet. A contributing factor may be excessive bodily activity, which increases the metabolic requirements beyond the caloric value of the food eaten. These patients are usually of a so-called nervous temperament. Other patients of the exogenous type are weak (asthenic leanness) with muscles poorly developed and lack stamina.

ENDOGENOUS LEANNESS is due to some other contributing factor within the body, such as malignancy, gastrointestinal disorders, chronic infectious diseases and endocrine disturbances. An increase in metabolic rate due to hyperthyroidism is frequently a cause of progressive weight loss. In such cases rest and medical treatment or surgery are indicated.

UNDERWEIGHT OWING TO MALNUTRITION or an inadequate diet may be a serious condition, especially in the young: Growth is retarded and efficiency impaired and, also, resistance to disease is reduced. It has been found that despite the general decrease in tuberculosis in the last few years, it has at the same time increased among young women between 15 and 24 years of age.

Underweight, like overweight, is a relative term, being based on the average weight for a given height, age and sex. More than 10 per cent below the average is usually considered abnormal, especially in persons under 25, and is worthy of medical investigation.

Diet for Underweight

The usual cause of underweight is an inadequate diet, the inadequacy being due to either the quantity or the quality of the food supply. A deficiency in calories, protein or its component amino acids, minerals or vitamins may produce faulty nutrition with loss of weight. A careful survey of the dietary habits of the patient should reveal any inadequacies. The most common dietary cause is insufficient fuel value or calories to meet the energy requirements. Calories must therefore be increased. Not only must the normal requirement be met, but an increase of 400 to 800 calories must be made to allow for storage. Fifty per cent above the normal is sometimes prescribed.

The diet, however, must be built up gradually, otherwise the patient may not be able to tolerate the sudden increase. Care must be taken to ascertain the likes and the dislikes of the patient and to prepare the food as appetizingly as possible, both as to methods of cooking and appearance when served. Above all, the patient must be instructed as to the necessity for co-operating by consuming all food served to him. Low-calorie soups, salads and beverages should not be taken at the beginning of a meal as they tend to give temporary satiety value and diminish appetite for the more substantial part of the meal.

Vitamin supplements are sometimes prescribed, especially thiamine chloride for the purpose of stimulating the appetite and improving digestion.

The objectives of this diet are:

1. An adequate diet, as described in Chapter 19.
2. Additional calories, which may be obtained by (a) increasing the quantity of the foods listed in the normal pattern, by (b) increasing the carbohydrates and, to some extent, the fats, by (c) frequent feedings to include nourishment between meals and before retiring at night.
3. An increase in protein to approximately 100 to 125 Gm. for adults in order to combat the deficiency due to malnutrition with loss of body tissue.
4. An abundance of vitamins and minerals, especially thiamine.
5. A reduction in bulk if not needed as a laxative in favor of foods with higher caloric value.
6. Easily digested foods. Carbohydrate-rich foods are especially indicated, since carbohydrate is both easily digested and quickly converted into body fat. Foods rich in fat may be used to increase the fuel value without unduly increasing the bulk, but they must be used with discretion. Greasy foods will lessen the appetite of many patients, and too much fat in any form is frequently distasteful unless cleverly disguised. The uncooked fats, such as cream, butter and salad oils, are more easily digested than fried foods.

HIGH CALORIC DIET FOR UNDERWEIGHT

Characteristics:

1. High in caloric value—25-50 per cent
2. High in protein (100-125 Gm. for adults)
3. Nourishment may be served between meals and before retiring
4. High in vitamins, especially vitamin B complex

Foods Allowed:

Eggs and dairy products—Milk and cream in abundance, eggs in all styles, cheeses of all kinds.
Meats, fish and fowl—All meats (bacon and fat meats are particularly indicated), fish and fowl
Soups—Preferably creamed or thick soups
Vegetables—All vegetables, including potatoes
Salads—All salads, oil dressings being especially desirable
Fats—All; butter used freely
Cereals—All cereals
Italian pastes—All kinds
Breads—Whole-grains or enriched
Beverages—Tea, coffee, cocoa, served with cream and sugar, fruit juices, malted preparations
Fruits—All fresh and cooked fruits, jellies, jams and marmalades
Desserts—Ice cream, custards, tapioca and rice puddings, cake, fruit desserts, simple desserts of all kinds, candy with meals if desired
Vitamin concentrates—Wheat germ, brewer's yeast (if ordered by the physician)

It will be noted that the above diet is a house or regular diet supplemented with cream, extra butter, high caloric desserts and nourishment between meals.

The nutritional value of the high caloric diet is easily determined by following the plan given on a previous page for the low caloric or reducing diet. It will be necessary, however, to add to the basic formula rather than subtract. Extra butter, cream, sugar and other sweets, as well as desserts, should be added in sufficient amount to meet the required number of calories prescribed.

REVIEW QUESTIONS

1. What reasons could you give an obese person to impress him with the need of losing weight?

2. What is the fundamental cause of obesity?

3. Plan a diet of 1,200 calories for one day. Show how it meets all the requirements for adequate nutrition.

4. What foods are of value in a low caloric diet to give it high satiety value?

5. What things besides diet are helpful to bring about reduction of weight? What things may be harmful?

6. What are some of the reasons for a person's being underweight?

7. What additions can you make to a regular diet to increase it by 1,000 calories?

8. A patient who should weigh 140 pounds is 25 pounds underweight. He says he eats a lot but just cannot gain weight. What advice would you give him about the diet he should follow? Plan a diet for him for a week.

21

Fevers and Infections

Chapter Topics

GENERAL DISCUSSION
  TYPES OF FEVERS
ACUTE FEBRILE CONDITIONS
SUB-ACUTE FEVERS
  TYPHOID FEVER
CHRONIC FEVERS AND INFECTIONS
  TUBERCULOSIS

GENERAL DISCUSSION

Fever is a condition that is characterized by an elevation of body temperature above that of the normal. It is due to an imbalance between heat production and heat elimination. Increased heat production alone will not cause a rise of body temperature. It has been shown that when one is engaged in strenuous exercise, even though the body has burned up much of its fuel food supply, the heat thus produced is lost through perspiration, evaporation and radiation from the skin. This balance is maintained through the autonomic reflex nerve centers and the endocrine system. When abnormal conditions such as infection or tissue damage in surgery prevail, this control is disturbed and fever then results. The condition is not therefore necessarily the result of excessive heat production, but rather the retention of an undue proportion of the heat produced.

Fever is always accompanied by an increase in metabolism. In most febrile conditions the metabolic rate is increased 7 per cent for each degree Fahrenheit. As a result, the carbohydrate stores are burned and there is destruction of body proteins. There is also a loss of body fluids and salts, especially sodium chloride. In planning the diet for such cases, these factors must be kept in mind.

Infections are by far the most frequent causes of the imbalance between heat production and heat loss as already described.

Types of Fevers. There are fevers of short duration, known as acute, such as occur with colds, grippe, influenza and pneumonia, while others "run a course" or are of longer duration and are known as subacute. Typhoid fever and subacute bacterial endocarditis, as well as certain types of pneumonia, are examples of the latter type. There are fevers which may last for months and even years, and may therefore be classed as chronic. Tuberculosis is the outstanding fever of this type.

If the fever is caused by infection, the degree of its severity usually indicates the intensity of the infection or the amount of toxin produced by the bacteria. As already indicated, the height of the fever is often proportional to the intensity of infection.

Whatever the cause, the intensity or the duration of the fever, the mechanism involved is the disturbed balance between heat production and heat loss. This may be due to an increase of heat production, to a decrease in the facilities for the discharge of heat produced, or to a combination of both conditions.

ACUTE FEBRILE CONDITIONS

Etiology and Symptoms. In acute febrile conditions resulting from infections or trauma, as in surgery or burns, both the energy metabolism and the protein metabolism are increased. The longer the fever lasts and the greater the elevation of the temperature, the greater will be the loss of protein from the blood and from the body tissues. This will be excreted chiefly in the urine in the form of nitrogen and its compounds. Body fluids also are lost, likewise the salts or minerals of the blood and the tissues.

Dietary Treatment

Because of the increased metabolism and the destruction of body protein, it will be necessary, sooner or later, to increase both the caloric and the protein intake. But since the digestion is also disturbed, and because the fever is of short duration, it is often advisable to disregard these needs for a few days in order to lessen the work of the gastro-intestinal tract. A diet consisting of 1,200 to 2,000 calories, adjusted somewhat to the appetite of the patient, will suffice through the early acute state of the fever. It is important, of course, that the food should be easily digested, that the feedings should be small and frequent, and that the protein should be adequate.

It is also now known that protein is essential in combating infection, since the antibodies which combat infection are proteins and are therefore dependent upon protein food intake. Because of this, high protein feedings should be given as early as possible in the treatment of the disease, and they should be increased to meet the demands of the illness (see high protein recipes in chapters on beverages and desserts—Part Three).

The liquid diet, page 226, is usually prescribed because the food is quickly and easily digested and is devoid of irritating substances. Another equally important reason is that in this way the fluid intake is increased. Three to four quarts of liquid per day are often prescribed in order to facilitate the elimination of the toxins resulting from the infection. Fruit juices, including lemon, orange, pineapple, tomato and grapefruit juices, are given frequently. Tea and coffee (not too strong) with cream and sugar may be given two or three times a day. Carbonated fluids may often be used to lend variety and to increase fluid consumption.

Strained soups are important as conveyors of vegetables and other foodstuffs, including salt (sodium chloride), which may be used to replace the body losses and water as well.

Milk, of course, is an excellent foundation for a liquid diet. Its importance has been noted in previous chapters. The addition of lactose, glucose, or cane sugar not only increases the caloric value but improves the flavor. Gruels, with or without milk, are also important. Feedings should be given every two hours. During convalescence certain solid foods, such as crisp toast with butter, toasted breakfast cereals (without bran), soft-cooked eggs, baked or mashed potatoes, and, later, vegetable purées, may be added. In other words, the liquid diet is followed by a soft diet, later by a light diet, and as soon as possible by a normal diet. If there has been loss of weight, it is advisable to give a high protein, high caloric diet. If the weight and protein loss has been considerable, the protein intake should be two to three times the normal requirement.

SUBACUTE FEVERS

Incidence. The subacute fevers or the longer fevers that "run a course" are not so prevalent as they were in the early part of this century when the mortality from such fevers was high. Since then the incidence has been greatly lessened by the sanitary control of food and the water supply which has been exercised under local, state and national departments of health. (See Chap. 14 which deals with food hygiene.)

Although typhoid fever is rather rarely seen now, it is, however, typical of the subacute fevers—for example, certain types of pneumonia which require the high caloric diet. This was developed through the research of Coleman [1] and Shaffer,[2] which at the time was considered revolutionary, since the previous practice was to "starve a fever."

Typhoid Fever

Typhoid fever is an infectious disease caused by the typhoid bacterium, which is usually transmitted by water polluted with intestinal wastes. It may, however, be conveyed through the milk supply, either because of contamination by a carrier working at the dairy or because the milk containers have been washed with contaminated water. This disease has also been spread through oysters grown in sewage-polluted water and occasionally through other foods.

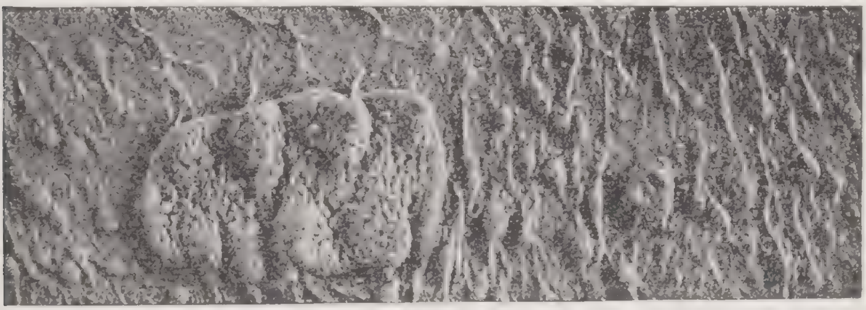

Fig. 51. Lining of intestine showing Peyer's patches and solitary follicles in typhoid fever. (Army Medical Museum 35073.) (Karsner.)

Symptoms. Typhoid fever is accompanied by high temperature, prostration and sometimes by diarrhea or constipation. Lymph nodules and portions of the intestinal tract are highly inflamed due to ulceration of a certain portion of the walls, known as Peyer's patches. The ulceration may be so severe as to cause hemorrhage and even perforation of the intestinal wall.

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[1] Coleman, Warren: J.A.M.A. 69:329 1917.

[2] Shaffer, P. A.: J.A.M.A. 52:974, 1908.

It is also accompanied by greatly increased protein metabolism and total energy metabolism. Lusk and Du Bois found that the energy metabolism was increased 40 to 50 per cent above the basal rate of metabolism—10 per cent for toxic destruction of body protein; 10 to 30 per cent for activity due to restlessness; and 10 per cent for the specific dynamic effect of food, the last being the same as in normal conditions.

DIETARY TREATMENT

Characteristics of Diet

From the foregoing statement of conditions it is apparent that the diet in typhoid fever should possess the following characteristics:

1. The diet should consist of soft and liquid foods. For the first few days the diet usually consists of liquids of high caloric value given hourly or every 2 hours.

2. The diet should be free from irritating substances, for skins, seeds and indigestible substances may cause hemorrhage or perforation, which may end fatally. Even gruels should be strained.

3. The diet should be high in calories. Coleman and Shaffer found that they obtained the best results when 3,000 to 6,000 calories were consumed daily—3,000 calories in the early stages, this amount being increased gradually through convalescence. Others state that approximately 3,000 calories should be given. It is necessary to increase the caloric intake gradually. "Starve a fever" is one of the many dictums that the searchlight of science has proven to be false.

4. The diet should be relatively high in protein. There is a great loss of body tissue because of the increased protein metabolism. This loss may be spared, however, providing the protein intake makes up the deficiency. It is generally recommended that the daily protein ration should not fall below 100 Gm. for adults. Many prescriptions now call for 150 or more grams per day. It must be in an easily digested form, however. Milk and egg dishes should form the basis of the protein ration. If necessary, protein hydrolysates may also be given either orally or parenterally (see page 251, Chap. 20).

5. The diet should supply from 250 to 400 Gm. of carbohydrate. A diet high in carbohydrate protects against the burning of body protein. Lactose and glucose taste less sweet than ordinary cane sugar and may be taken in larger quantities without disturbing the appetite. Malt sugar and dextrin preparations are also advantageous. In some cases an excess of carbohydrate may cause gas formation or tympanites, in which case it should be reduced and additional protein or fat given.

6. The diet should supply from 100 to 250 Gm. of fat and may in exceptional instances be increased to 300 Gm. It should be in a form that is readily digested. Emulsified fat such as that found in cream and in egg yolk is best adapted to meet the needs of the fever patient. Butter may also be used. It is important, however, that the patient be watched carefully, as an excess of fat may cause digestive disturbances that result in diarrhea.

7. The diet should contain an abundance of liquid, consisting of milk, cream, fruit juices and other beverages. Coffee, tea, cocoa, and ginger ale should be served with cream to add to the caloric value. At least 2 quarts of fluids should be given daily.

8. Foods Allowed:

Cereals and Breads: Cooked, refined or white cereals, such as farina, cream of wheat or rice and prepared cereals without roughage, such as cornflakes, rice krispies or puffed rice; white bread (toasted if desired); white crackers.

Fruits: Fruit juices, applesauce, fruit purées, jelly, ripe bananas.

Vegetables: Potatoes, baked or mashed, strained carrots, peas, celery, asparagus, spinach, tomatoes or asparagus, to be used as a basis for cream soups.

Eggs: Soft boiled, poached, eggnog.

Dairy Products: Milk, malted milk, cream, butter, cream cheese, cottage cheese.

Desserts: Ice cream, without fruits and nuts, sherbet, custard, junket, puddings—rice, cornstarch, tapioca—and bread, plain gelatin, without fruits or nuts.

Beverages: Tea, coffee, cocoa, coffee substitutes, preferably served with cream, and ginger ale.

9. The feedings should be regular and at frequent intervals, usually 2 or 3 hours apart.

10. Foods to Be Avoided:

Meats, fish and poultry (until a soft diet is permitted).

Hard cheeses if rich or strongly flavored.

Nuts and legumes.

All fried foods and all pastries.

All coarse cereals and breads (especially bran preparations).

Vegetables, except potatoes and those that are strained.

Fruits, except those listed above.

A Typical Diet

Although much of the research work with typhoid fever was done many years ago by Coleman and others, their work remains classic. Coleman's diet began with 8 feedings of a milk, cream and lactose mixture, the proportions being gradually increased so that the total calories ranged from 1,000 to 3,900. Following the milk, cream and lactose mixture, additional foods such as eggs, refined cereals, milk toast, custard, mashed potato and applesauce were given as rapidly as the patient's condition would permit.

With some modifications, the typhoid diet of today is based on Coleman's work. The chief difference is that a higher protein intake is now considered essential.

The following diet[3] is typical of the treatment now given typhoid-fever patients:

3,000 Calorie Soft and Liquid Typhoid-Fever Diet

	Calories
6 A.M. Orange Albumin	320
Orange juice, 8 ounces	
Lactose, 2 tablespoons	
Cane sugar, 1 teaspoon	
Egg white, 1	
8 A.M. Gruel	370
Strained cereal, ¾ cup	
Sugar, 1 tablespoon	
Cream, 4 ounces	
10 A.M. Eggnog	198
Milk, 5 ounces	
Egg, 1	
Sugar, 1 teaspoon	
12 NOON. Milk Toast	313
Bread (toasted), 2 slices	
Milk, 8 ounces	
Sugar, 1 teaspoon	
Junket	259
Milk, 8 ounces	
Cream, 2 ounces	
Sugar, 1 tablespoon	
Rennet tablet, 1	

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[3] Diet Manual, prepared by the Department of Nutrition, University of Kansas Hospitals, Lawrence, Kansas, Univ. Kansas Press 1945.

2 P.M. Cocoa, hot or cold	262
Cocoa, 2 teaspoons	
Water, 1 cup	
Cream, 3 ounces	
Sugar, 2 teaspoons	
4 P.M. Ice Cream	480
Cream, 4 ounces	
Milk, 2 ounces	
Sugar, 4 tablespoons	
6 P.M. Cream Celery Soup	330
Strained celery, ½ cup	
Cream, 3 ounces	
Milk, 3 ounces	
Butter, 1 tablespoon	
8 P.M. Custard	366
Egg, 1	
Milk, 3 ounces	
Cream, 3 ounces	
Sugar, 1 tablespoon	
MIDNIGHT. 1 cup hot cocoa	
As above	262
Total	3,160

As the condition of the patient permits, other foods are added. After a few days on a liquid diet, foods from the soft diet are added, as illustrated by the liquid and soft diet given above. Later a full soft diet is given, still later the light or convalescent diet, and, finally, the full or regular diet. (Consult table of standard diets in Chapter 19.) These diets, however, are made high caloric also by the addition of high caloric beverages (see Chap. 37). As convalescence proceeds, the number of feedings will be reduced from the 8 to 10 small feedings daily (as in the liquid diet) to 4 or 5 larger feedings daily.

CHRONIC FEVERS AND INFECTIONS

The regular afternoon fever, continuing perhaps for a long period of time, is usually the symptom which causes the tuberculous patient to seek medical aid. This elevation of temperature may continue for months and even years, thus becoming, indeed, a chronic condition.

TUBERCULOSIS

Etiology and Symptoms. Of the chronic infections one of the most dreaded is tuberculosis—a malady from which the human race has suffered long. Volumes have been written about it and it still engages the interest of hundreds of specialists in the medical profession. The infection is due to the tubercle bacillus, which may affect any or all tissues of the body, but the lungs are more commonly affected. Pulmonary tuberculosis is characterized by the elevation of temperature already mentioned, by coughing and expectoration, by loss of weight and strength, and by alternating periods of activity and remission of symptoms.

DIETARY TREATMENT

Proper feeding is highly important in treatment. There has been some difference of opinion, however, as to what is the best type of diet. At one time a very high protein diet was recommended. Not only were large quantities of meat (chiefly raw) served, but, in addition, from 3 to 12 eggs per day and from 1 to 3 quarts of milk. Another diet in use at one time introduced a very large amount of fat on account of its theoretical specific effect.

It is now believed that the caloric intake should be sufficient only to maintain body weight at normal or slightly above normal: that is, from 2,500 to 2,800 calories for a patient at bed rest; to 3,000 calories for the ambulatory patient. It is known that the basal metabolism of the tuberculous patient is increased only moderately and that destruction of body tissues (protein) is not so marked as in typhoid fever. Nevertheless, the protein intake should be liberal, averaging from 75 to 125 Gm. per day for adults. Carbohydrates are believed to increase the respiratory volume and therefore the work of the lungs; hence they are restricted to some extent. Fats do not increase the work of the lungs and are therefore given in generous amounts, the amount being adjusted to the ability of the patient to digest fat.

Recent findings[4] indicate that the tuberculous patient requires vitamin C in much larger quantity than a normal person. This may be given in concentrated form intravenously, but the diet should also provide it in liberal amounts.

Additions of the fat-soluble vitamins are also important. Vitamin D is believed to be essential because of its effect on the absorption and the retention of calcium. Vitamin K is also needed because of its role in the production of prothrombin, which in turn helps prevent hemoptysis or bleeding from the lungs. Vitamin A is also important. Foods rich in these vitamins should form an important part of the diet. Of course the vitamins of the B complex are also necessary, as in all normal diets.

Of the foods especially indicated in tuberculosis, milk stands at the head of the list because of its high content of excellent protein, calcium and vitamins. At least a quart a day should be consumed. This may be taken in almost any form desired. The cultured milks, such as acidophilus milk, yoghurt, or even buttermilk, are fre-

FIG. 52. Soured milk, known as yoghurt, is a staple article of diet in Turkey and the Near East. A lemon is used as a stopper for the milk bottles by this vender in Istanbul. Yoghurt and similar preparations are valuable in typhoid, tuberculosis and other fevers.

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[4] Sweeney, H. C., *et al.*: J.A.M.A. 116:469, 1941.

3,000 CALORIE DIET FOR TUBERCULOSIS

Menu	Amount Gm.	Protein	Fat	Carb.	Calories
Breakfast					
½ Grapefruit	100	1	..	10	44
2 Eggs	100	13	12	1	164
2 Slices toast (thin)	40	4	1	21	109
1 Serving cereal (small)	15	2	1	10	57
½ Cup milk	100	4	4	5	70
¼ Cup cream (20%)	50	2	10	2	106
2 Pats butter	20	..	16	..	144
1 Teaspoon sugar	5	..	..	5	20
Midmorning Nourishment					
1 Glass malted milk made with milk	200	8	12	26	244
Dinner					
1 Cup consommé Julienne (6% vegetable)	50	1	..	3	16
1 Serving roast beef	75	14	18	0	218
1 Serving mashed potato	100	3	8	19	160
1 Serving string beans	50	..	..	2	8
1 Serving head lettuce	30	..	..	1	4
1 Teaspoon olive oil	5	..	5	..	45
1 Cloverleaf roll	30	2	2	15	86
1 Pat butter	10	..	8	..	72
1 Ounce cream (35%)	30	1	11	1	107
1 Medium baked apple	200	..	..	24	96
1 Teaspoon sugar	5	..	..	5	20
1 Cup coffee					
Midafternoon Nourishment					
2 Crackers	16	1	2	11	66
1 Glass tomato juice	200	2	..	8	40
Supper					
1 Cup cream of mushroom soup	150	3	5	9	93
1 Serving canned fish with	50	10	5	..	85
lettuce and tomato	50	1	..	3	16
1 Teaspoon mayonnaise	5	..	4	..	36
1 Stuffed baked potato with	150	6	12	30	252
American cheese	15	4	5	..	61
1 Slice whole-wheat bread	20	2	1	10	57
1 Pat butter	10	.	8		72
¼ Cup cream (20%)	50	2	10	2	106
1 Serving milk sherbet	100	2	3	25	135
1 Serving sponge cake (small)	15	1	1	9	49
1 Teaspoon sugar	5	0	..	5	20
1 Cup coffee					
Evening Nourishment					
1 Cracker	8	1	1	6	37
1 Cup cocoa	200	6	4	12	108
Totals		96	169	280	3,023

quently more easily digested than sweet milk, and have at least the advantage of introducing variety into the diet.

Eggs in moderation are also desirable and may be taken in any easily digested form. Soft-cooked eggs are more quickly digested than raw eggs. Meat, fish, poultry and cheese should be used freely in the diet. Fat in the emulsified form is preferable to the free fats; therefore, as already stated, cream, butter and egg yolks should form a prominent part of the fat requirements. Fruits and the easily digested vegetables should be included because of their laxative properties and richness in vitamins and in mineral salts. If constipation needs to be corrected, further additions of a laxative nature may be made. The food should be simple and easily digested.

It should always be remembered that the appetite of the tuberculous patient is very likely to be capricious, due to the toxic products of the disease. For this reason constant care should be given to the variety and the attractiveness of his diet.

The diet for pulmonary tuberculosis should have the following characteristics:

1. Caloric value slightly above normal, or sufficient to maintain weight at normal or slightly above
2. Protein 75-125 Gm.
3. Fat somewhat higher than normal and in easily digested form
4. High calcium content
5. High content of vitamins, especially A, D and K; also ascorbic acid
6. Nourishment between meals and before retiring, and
7. It should be on the basis of the light diet (see Chap. 19).

Typical Diet. On the opposite page is a day's diet for a patient requiring 3,000 calories and approximately 100 Gm. of protein.

REVIEW QUESTIONS

1. Why does an athlete not have a fever although he expends a great deal of energy?
2. A patient has a basal caloric requirement of 1,800 calories and he is running a temperature of 104°. How many more calories will he need because of this temperature? What else will increase his caloric needs?
3. What are the characteristics of the diet used for typhoid fever? Explain the reason for each one.
4. What should be considered in the feeding of patients with tuberculosis?
5. Plan a diet of 4,000 calories for a patient for 1 day.
6. Suggest 5 different high caloric in-between meal feedings that a patient may use to increase his caloric intake.
7. What additions can be made to the regular diet to increase the calories?

22

Deficiency Diseases

Chapter Topics

GENERAL CONCEPT OF DEFICIENCIES
DEFICIENCY DISEASES AND RELATED CONDITIONS
  PROTEIN DEFICIENCIES, STARVATION AND NUTRITIONAL EDEMA
  DISORDERS DUE TO VITAMIN A DEFICIENCY
    NIGHT BLINDNESS (NYCTALOPIA) AND GLARE BLINDNESS (HEMERALOPIA), XEROSIS, XEROPHTHALMIA AND OTHER CONDITIONS
  BERIBERI AND OTHER DISORDERS DUE TO THIAMINE DEFICIENCY
DEFICIENCY DISEASES AND RELATED CONDITIONS (CONT.)
  PELLAGRA AND RELATED DEFICIENCIES
  RIBOFLAVIN DEFICIENCY
  SCURVY AND OTHER EVIDENCE OF ASCORBIC ACID DEFICIENCY
  RICKETS
  OSTEOMALACIA
  DENTAL CARIES
  HEMORRHAGIC DISEASE OF INFANTS
  NUTRITIONAL ANEMIA
  SIMPLE OR ENDEMIC GOITER
EARLY DIAGNOSIS AND TREATMENT OF NUTRITIONAL FAILURE

GENERAL CONCEPT OF DEFICIENCIES

The recognition of deficiency diseases antedated in most cases discovery of the food deficiency responsible for the clinical picture. Only after a study of the pathologic state resulting from a controlled or measured deficiency of a specific food factor has it been possible to define the functions of that factor in normal tissue. A study of protein, minerals and vitamins should precede and should be reviewed in connection with the study of this chapter. (See Chaps. 5, 7 and 8.)

A deficiency disease or state in the broadest sense is any pathologic or subnormal condition for which some specific food deficiency is wholly or partially responsible. A deficiency disease may involve a secondary infection or metabolic disturbance which makes it difficult to draw a distinct line between types of diseases. A deficiency state may lower resistance to infection, and certain infections and metabolic disturbance may bring about deficiency states by interfering with normal absorption and utilization of nutrients. The latter situation is known as conditioned malnutrition.

Many diseases not classed as deficiency diseases may be aggravated or even initiated by malnutrition. New concepts of this type have come from wartime and postwar findings among malnourished peoples. Increases in cases of intestinal diseases, ulcer and hernia were associated with undernutrition in Holland in the winter of 1944-1945.[1]

While specific deficiency diseases are emphasized in this chapter, mild and chronic deficiencies, more often encountered as secondary to other conditions, are also mentioned. Underweight and undernutrition due to lack of sufficient quantity of food have also been discussed in Chapter 20. Early diagnosis and treatment of nutritional deficiencies are discussed briefly later in this chapter.

Deficiency diseases are frequently the result of multiple deficiencies and the complex syndrome is difficult to diagnose. Usually, however, a specific disease entity is associated with some one factor more than with others. Such diseases are so classified in this chapter for convenience, but the reader's attention is called to the multiple nature of deficiencies.

DEFICIENCY DISEASES AND RELATED CONDITIONS

Protein Deficiencies, Starvation and Nutritional Edema

Incidence. The severe condition of starvation edema is seldom encountered, except during wars or famines, when there are prolonged food shortages. The condition has been reported in the histories of most wars: it was common in Europe in the First World War, and it has been again reported during and since the Second World War. In the winter of 1944-1945 in nine cities and several smaller communities in North Holland there were as many as 125,000 cases of hunger edema, not including infants.[2]

This report and others from war zones indicated that the occurrence and the severity of the edema were not closely related to the degree of protein deficiency, although formerly the two conditions were closely associated. Typical starvation edema was more apt to be the manifestation of starvation in adults, while in children growth was stunted.

Severe hypoproteinemia with or without edema is most apt to occur under war and famine conditions also, but the full significance of the condition has only recently come to be appreciated. Well-controlled laboratory observations[3] on men restricted to starvation rations have demonstrated the resulting syndrome, the counterpart of which was so frequently encountered in war-torn countries. The diet and the treatment most advantageous for recovery were also studied under controlled conditions.

Protein deficiency may occur without starvation, and actually is a common complication of debilitating disease. It may occur following surgery, wounds and severe burns, and it is not an uncommon accompaniment of gastric ulcers and liver and kidney diseases. It may also be a complication of pregnancy.

Etiology. Starvation or hunger edema was formerly attributed to a lack of protein exaggerated by a simultaneous shortage of calories. There is still a close relationship between these conditions, but nutritional edema cannot be entirely explained as due to a low serum protein with resulting upset balance of osmotic pressure between the cells and the body fluids. It is more likely due to some change in permeability of the capillary walls either toxic in character or of unknown origin. It is most frequently encountered in starvation, and it disappears when adequate food is given.

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[1] Stare, F. J.: Nutrition Rev. 3:225, 1945.

[2] *Ibid.*

[3] Keys, Ancel: J. Am. Dietet. A. 22:582, 1946.

Protein, which is almost always in short supply under famine conditions, may also be deficient at other times. It has long been recognized that protein is indispensable as a constituent of body cells and fluids and as a regulator (see Chap. 5). Only recently has science demonstrated the clinical picture of protein deficiency and the several ways in which it may occur.

Youmans[4] lists the following conditions as causes of protein deficiency:

1. Deficient intake of protein as related to quantity and to quality (essential amino acids).
2. Failure of absorption or utilization, as in gastro-intestinal diseases.
3. Abnormal destruction or loss from the body, as in nephrosis, when large quantities of albumin are excreted by the kidneys, and in severe burns, when the exudate continues for some time.

Youmans also points out the importance of the caloric intake when he says "of almost greater importance in some cases than the actual amounts of protein is the caloric intake. This is because protein is burned for heat (calories) in the absence of sufficient fat and carbohydrates to supply energy requirements. When the amount of protein in the diet is near minimal, the use of some of it for fuel may make the supply inadequate, and amounts which appear adequate may actually be insufficient."

Symptoms and Pathology. When protein deficiency occurs, various symptoms such as loss of weight, strength and appetite may be noticed. But since these are characteristic of many diseases, it becomes necessary to resort to laboratory tests to determine the deficiency. The blood is tested for total nitrogen and for the serum proteins—albumin and the globulin fractions. If these are below normal, a deficiency is indicated. If both the albumin and the globulin fractions are low, the condition is described as hypoproteinemia, but if the albumin fraction is especially low, while the globulin fraction is fairly normal, the condition is known as hypo-albuminemia.

Urine tests may reveal a seepage of albumin into the urine, which of course is a source of depletion of the body protein, since a loss of 1 Gm. of albumin indicates a loss of 30 Gm. of body protein. Nausea and vomiting may also result in the loss of protein through decreased intake. Microscopic examination of tissue protein has revealed tissue damage which after long periods of deficiency or starvation it may require many months to restore to normal. Full recovery may never occur.

Edema accompanying prolonged starvation has characteristics of clinical significance. According to Youmans:

> The edema, although not the earliest result of protein deficiency, in our present state of knowledge is about the first clinical sign of the deficiency. One of the characteristics of the edema is its lack of association with symptoms suggesting other causes of edema, notably heart and kidney disease. . . . The edema is strikingly dependent on posture, confined to or greatest in dependent parts and, especially in the mild or early stages, shifting from part to part with posture,

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[4] Youmans, J. B.: J.A.M.A. 128:439, 1945.

present in the hands and face in the morning and in the legs at night.

In the mild form the edema is usually painless and bilateral, and develops gradually. There may be an increase in weight, any loss of body tissue being masked by the edema. Weakness, lassitude and mental depression are common, and there is likely to be polyuria, especially nocturia. When other disease symptoms are present they are apt to overshadow those due to protein deficiency.

Children deprived of adequate food with protein markedly deficient become emaciated and growth is definitely retarded. Occasionally they show some evidence of edema, but it is less marked than in adults. Even after they have been receiving adequate food long enough to have regained average weight for height they are still under height for their age. One relief worker reported surprise upon learning that a little fellow who appeared to be about 8 years old was actually 12, and this happens repeatedly. On the other hand, the facial expression of such children is too mature for their age.

Treatment. An adequate diet with abundant calories and a liberal quantity of good-quality protein might seem to be the obvious and the only treatment necessary for recovery from the symptoms of starvation and protein deprivation, but it is not quite so simple. People who have been deprived of food or who have had 1,000 calories or less for extended periods have a decreased capacity for food and must be provided with a graduated increase in food of the right kind. The tolerance for fat is usually low, causing diarrhea or increasing that already present. In the rehabilitation of Dutch children in England they were given 1,800 calories the first day and this was increased to 2,400 only at the end of the first week.

It is obvious that in cases of protein deficiency a high protein intake should be provided as soon as it can be tolerated, also a high caloric intake to prevent body and food proteins from being used as sources of energy. While 70 Gm. of protein are considered normal for an adult, two to three times this amount is usually prescribed and in critical cases even 300 Gm. are sometimes given.

If possible, the protein should be given by mouth in the form of foods such as are listed in Chapter 5. Dried milk products and eggs are especially desirable as sources of protein for between-meal feedings (see Chaps. 37, 38 and 43). In case the patient is unable to eat the required amount, it may be necessary to resort to tube feeding; and in critical cases intravenous feedings may be necessary, in which case amino acids in the form of a protein hydrolysate obtained by an enzymatic digest of protein may be substituted for the food protein or may be given in addition to it. Amino acids may also be given orally as a supplement, in which case they may be given in water alone or with a mixture of glucose, salt and vitamins, and sometimes minerals such as iron.

In the treatment of severe emaciation and protein starvation in Europe Pollack [5] found that extreme cases did not respond well to the use of protein hydrolysates either orally or intravenously. They did make remarkable recoveries on thick eggnog mixtures made from dry skim milk and dried eggs. In these cases the irritable digestive tract and the weakened heart condition made the body incapable of tolerating the hydrolysate, which theoretically should have been beneficial. The bland milk-egg mixture high in protein was better tolerated and brought results. Blood and plasma transfusions were also given as an emergency source of protein.

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[5] Pollack, H.: J. Am. Dietet. A. 23:410, 1947.

Disorders Due to Vitamin A Deficiency

Night Blindness (Nyctalopia) and Glare Blindness (Hemeralopia)

Incidence. Mild deficiencies of vitamin A with a variety of manifestations are widespread in the United States. One of the early signs long associated with this deficiency is night blindness. In Labrador and in Newfoundland, where this condition has been recognized for generations, the popular remedy is fish liver, which the people rarely eat as food but will take as medicine. Varying degrees of night blindness are discovered among children and adults in this country when instruments for detecting and measuring adjustment to dull light are used for routine examinations of large groups. In general, it tends to be more prevalent among low-income groups, but some cases are found in almost any group.

Glare blindness (hemeralopia), closely related and essentially similar to night blindness, was recognized when automobile drivers complained of being unable to drive at night because of the glare of headlights (see Figs. 53 and 54). During the war potential night pilots were examined especially for this condition and the liberal intake of vitamin A was recommended as a preventive.

Etiology and Pathology. Both nyctalopia and hemeralopia are functional disorders resulting from the slow regeneration of visual purple in the

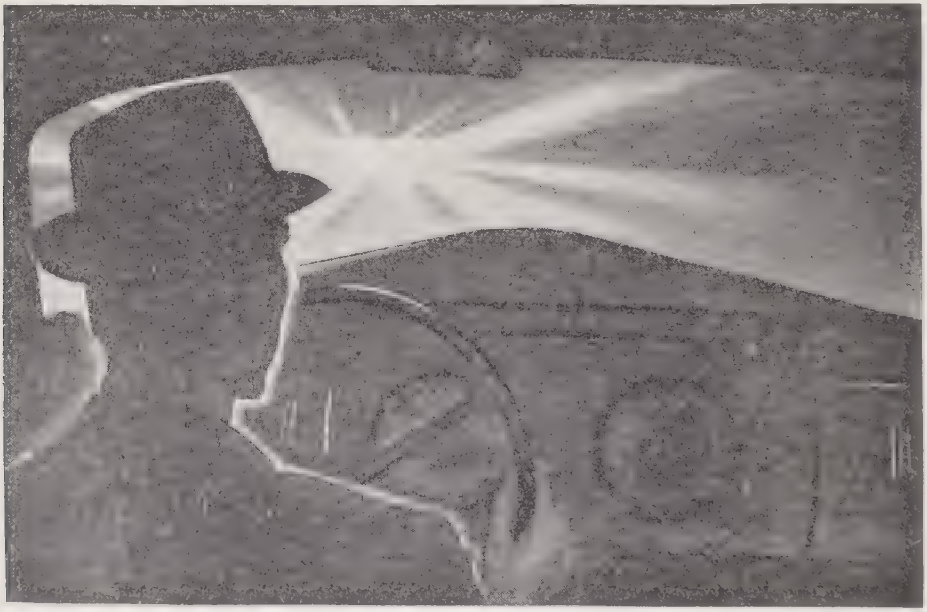

Fig. 53. "Glare blindness" often is a symptom of vitamin A deficiency. Headlights dazzle the eyes and cause discomfort. The driver is temporarily blinded from oncoming headlights, and the edge of the road is seen with difficulty.

Fig. 54. An adequate intake of vitamin A protects against "glare blindness" or remedies it. Properly focused headlights no longer dazzle so blindingly, and the road edge can be seen almost immediately after the headlight glare has passed.

retina of the eye. The difficulty is usually insufficient vitamin A to combine with the protein of the retina for the regeneration of visual purple, which is bleached to visual yellow under the influence of bright light. Regeneration of visual purple takes place in the dark, but replenishment of vitamin A from the blood stream is necessary to hasten the reaction, i.e., to permit adaptation in the shortest possible time.

Symptoms and Diagnosis. A person may have a mild degree of either night or glare blindness and not be aware of it unless his attention is drawn to it by some circumstance or special test. One person may be slower than another in adjusting to the dull light of a movie theater, but neither is aware of a difference. This is not a condition which causes sufficient discomfort to prompt one to consult medical advice unless it reaches an advanced stage. Various types of instruments have deen developed to test for light adaptation, but none of them is entirely satisfactory. One form of adaptometer is shown in Figure 55.

Treatment. A daily intake of 5,000 I.U. of vitamin A is more than enough to prevent night blindness or any related condition, unless for some reason the person is unable to use this vitamin or convert carotene into vitamin A. Usually a food source of this vitamin is sufficient to clear up a mild pathologic state, but numerous fish-liver-oil concentrates are available as more potent sources if their use is advised. The fish-liver-oil concentrates are preformed vitamin A and come in the usual 5,000 or 10,000 I.U. per capsule, and for special high dosage in 25,000 and 50,000 I.U., which may be prescribed for a quick saturation of

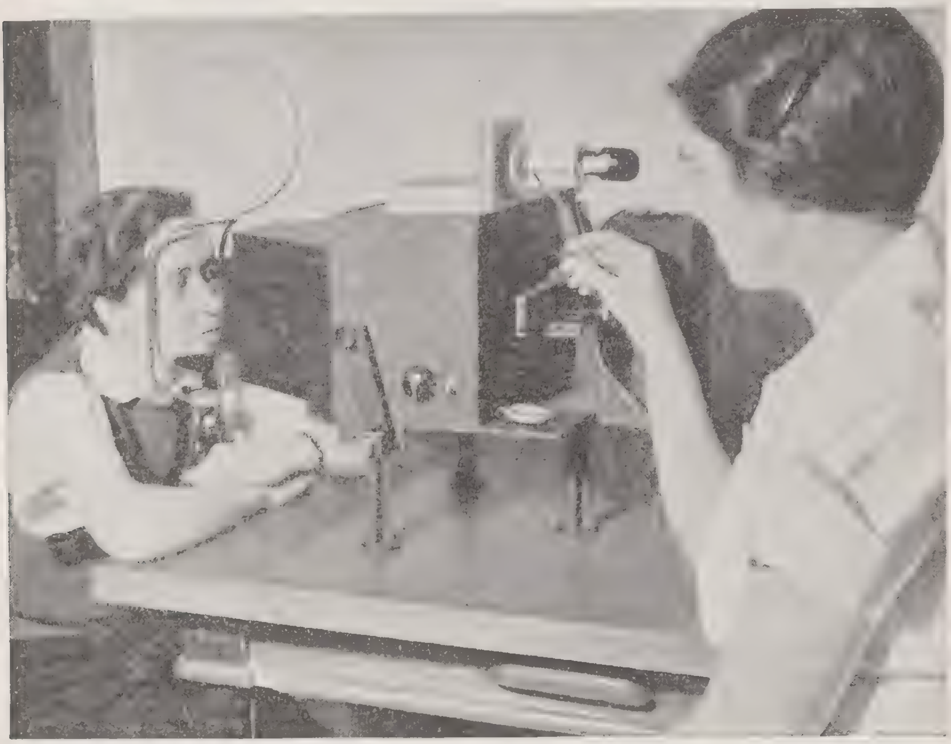

Fig. 55. Vitamin A. Testing for nutritional night blindness. (U. S. Bureau of Home Economics.)

the tissues. For food sources of vitamin A and further discussion of the subject see Chapter 8.

Xerosis

Incidence. Xerosis, an early change in the outer layers of the eye, is a fairly widespread manifestation of vitamin A deficiency among lower-income groups. Gross examination in a good light reveals some of the pathologic changes, but diagnosis is usually based upon more careful examination with proper instruments.

Symptoms and Pathology. The first symptoms of xerosis are itching and burning with a mild photophobia usually accompanied by redness of the lids and some inflammation. There is probably a secondary infection, but this is not as severe as in xerophthalmia.

Treatment. An adequate food source of vitamin A is usually sufficient as a preventive, but more concentrated sources, as already described, may be prescribed by a physician until the condition has cleared.

Xerophthalmia

Incidence. The more severe manifestations of vitamin A deficiency are rare in this country but relatively common in China and in India, and occurred during World War I in Denmark when most of the dairy products were being shipped out of the country, skim milk only being retained for home consumption. When whole milk was rationed, a pint per day per child.

the eye condition was promptly conquered, proving it to have been of nutritional origin. It is most common among infants, but it may occur at any age.

Etiology. Xerophthalmia is due to a secondary and serious infection of the cornea. This occurs when the protective secretions of the eye are decreased as a result of keratinization of the epithelial cells which follows a vitamin A deficiency.

Symptoms and Pathology. In infants affected with this eye condition there are usually numerous other evidences of malnutrition, such as stunted growth and anemia. Adults usually develop hemeralopia before the ophthalmia appears. The cornea becomes dry and lusterless, and eventually opaque and soft. This infection, once started, may spread rapidly and destroy the eye before the deficiency can be corrected or the infection conquered. (See Fig. 56.)

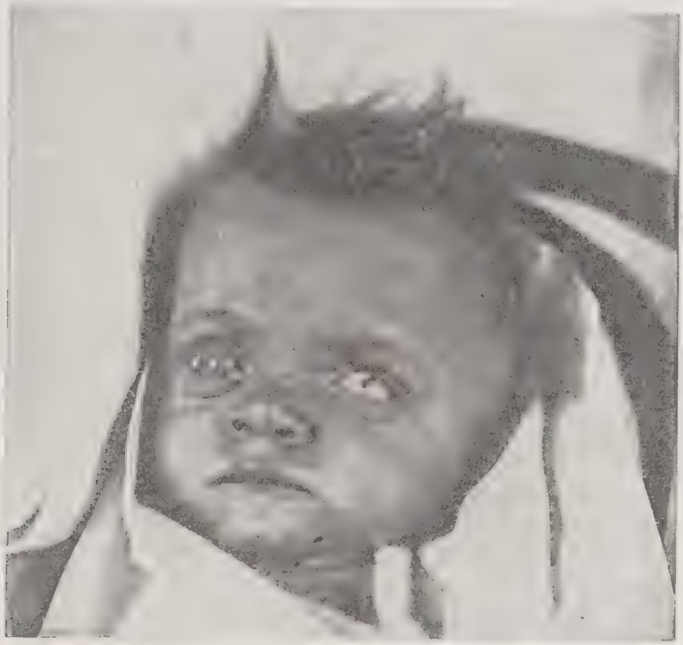

FIG. 56. Xerophthalmia, the result of a diet that is deficient in vitamin A. (Marriot, W. McK.: Infant Nutrition, St. Louis, Mosby.)

Treatment. Obviously a food source of vitamin A would not be sufficient to cure an acute case of xerophthalmia, and massive doses of vitamin A in the form of concentrates would probably be prescribed by the attending physician. Food rich in vitamin A would, however, be adequate as a prophylactic measure.

Other Conditions Due to Vitamin A Deficiency

Cutaneous lesions may appear early in adults and have a characteristic appearance. Papules tend to form round hair follicles on outer surfaces of arms, legs, shoulders and lower abdomen, and are described as having a "gooseflesh" appearance. They usually disappear when an adequate food source of vitamin A is provided. (Fig. 57.)

Respiratory-tract infections are often aggravated by a vitamin A deficiency which allows keratinization of epithelial cells in the respiratory passages, thus reducing their natural resistance to infection. Bronchitis, sinusitis, otitis media and pneumonia are all possible consequences of such lowered resistance due to pathologic changes in the mucous membranes. The relation of vitamin A deficiency to the common cold is still an open question.

Genito-urinary-tract changes may also occur as a result of vitamin A deficiency. The epithelial cells in the vagina of the female undergo changes which interfere with the normal oestrus cycle, and atrophic changes in the testes of the male may result in permanent damage. Urinary calculi have also been reported in humans as a result of diets deficient in vitamin A, especially in India. Time may disclose many other complications due to epithelial-cell changes resulting from this deficiency.

BERIBERI AND OTHER DISORDERS DUE TO THIAMINE DEFICIENCY

Incidence. The frank deficiency disease known as beriberi is of historic significance among the rice-eaters of the Orient and it still occurs today. It is described in early Chinese history, and some of the earliest attempts to treat it are reported from Japan and the Philippines. Takaki, a medical officer in the Japanese navy, proposed the theory that the food must be at fault and set about correcting the situation by trying a change in the ration. By decreasing the rice and increasing the barley and the vegetables in the diet, the number of cases of beriberi occurring during a 9-month voyage was reduced to 14 as compared with 169 on a previous similar voyage when the old ration was in use.

The extreme condition of human beriberi is seldom encountered in North America, except in certain isolated communities where the food supply is exceedingly limited. Such a situation occurs in northern Newfoundland and Labrador, particularly during the winters following poor fishing seasons, when food becomes scarce and the people are eating chiefly white bread, oleomargarine, tea and molasses.

Etiology. Beriberi, as such, results only from a long-time deficiency such as may occur among people who eat a limited diet habitually. When the thiamine intake is insufficient but not extremely deficient over an extended period of time, milder and ill-defined symptoms described below may result.

Symptoms and Pathology. Symptoms of the disease are gastro-intestinal disturbances, such as chronic constipation, due to decreased motility and degenerative changes in heart muscle, and loss of function or paralysis of lower extremities, due to a multiple neuritis. The latter condition, which is most disabling, is often the only symptom recognized by the native as a part of the disease and, therefore, many of the milder cases of beriberi which do not reach the stage of paralysis are never diagnosed as beriberi. The two common types of beriberi, known as the wet form and the dry form, are closely related, although they present quite a different appearance to the casual observer (as in Fig. 58). Both types show muscle degeneration, loss of motor function and loss of sensation. In the more

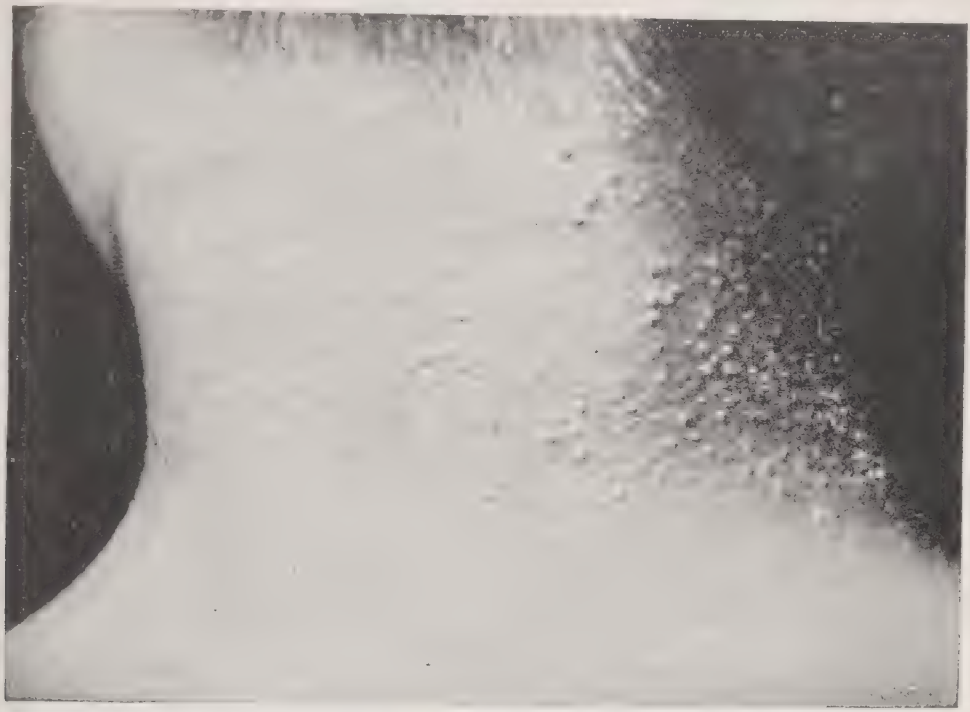

FIG. 57. Keratotic follicles and scaliness in vitamin A deficiency ("goose-flesh" appearance). (Hoffmann-La Roche, Inc.)

acute form fluid may accumulate in certain areas, masking the real emaciation by the edema. In the dry form, which is more chronic, the emaciation is more evident because there is no edema, but the other symptoms are similar. The value of an adequate food supply is generally recognized, but the lethargy and the ignorance of the people among whom these conditions are most prevalent prevent rapid progress in the improvement of food habits.

Less severe or less prolonged thiamine deficiency may be a contributing factor in malnutrition in children and in certain chronic diseases of middle age not ordinarily considered of nutritional origin. Since the thiamine requirement is roughly proportional to the metabolic rate, the high-strung nervous individual may need a more liberal supply than a lethargic person. Possible symptoms of a vitamin B_1 deficiency are muscular and nervous fatigue, often vague or ill-defined, with or without indigestion and constipation. Cardiovascular manifestations of this deficiency may respond to the administration of thiamine. There are other manifestations also, such as anorexia and nausea, which are improved by the same factor. It should be remembered that the symptoms mentioned frequently appear before a diagnosis has been made. Response to vitamin therapy may be a means of diagnosing border-line cases.

Treatment. Adequate food sources of thiamine are sufficient to prevent any of the deficiency conditions described. but when the pathologic symptoms appear more concentrated sources of thiamine are usually necessary for prompt recovery. Anorexia and nausea are often so severe as to preclude an adequate food intake until symptoms have been relieved by the administration of concentrates.

Since most of the cases diagnosed as beriberi in regions where it is prevalent are suffering from multiple deficiencies, it is customary for the physician to prescribe B complex concentrates rather than pure thiamine. The dosage for therapeutic purposes is often several times the recommended allowance of 1.2 to 2.0 mg. of

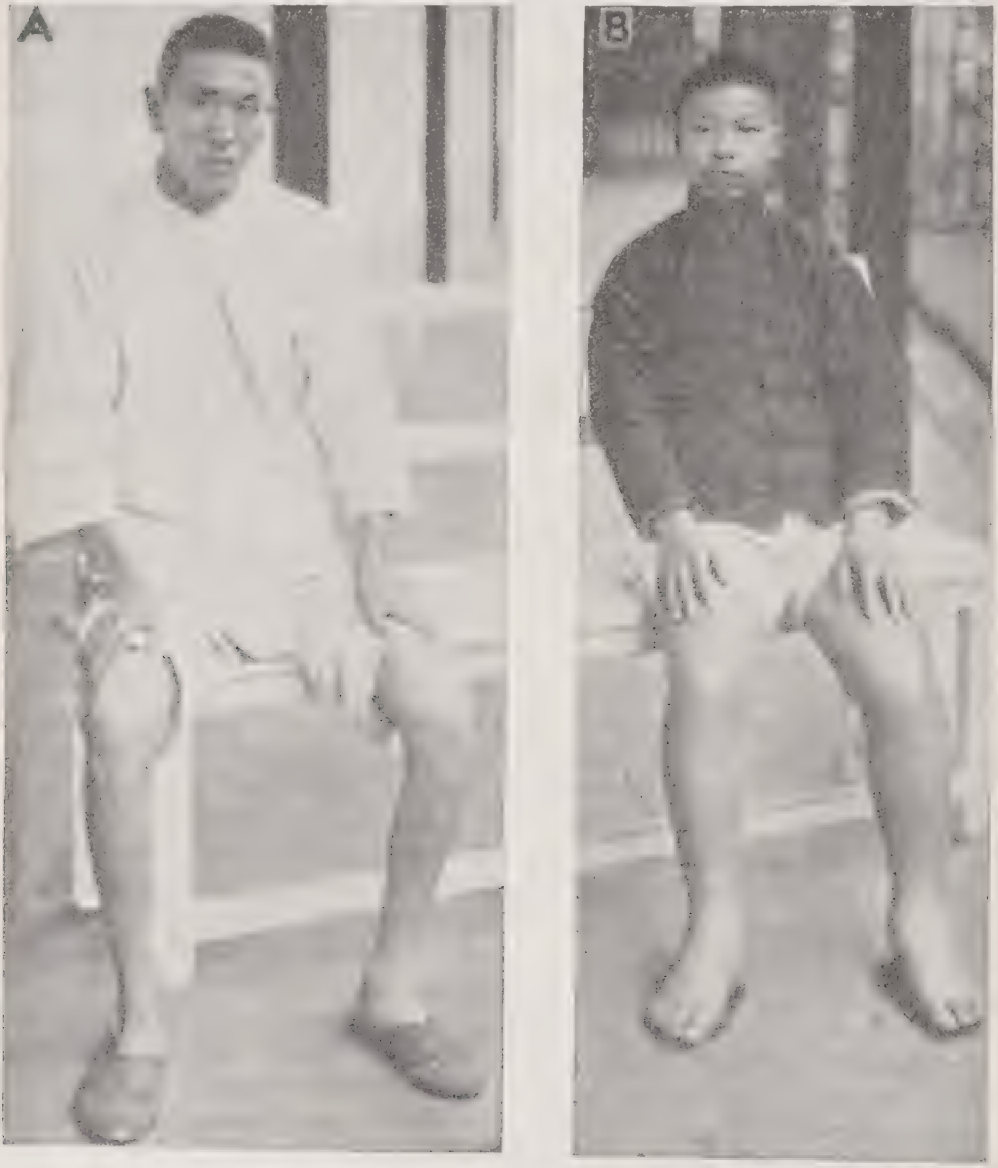

Fig. 58. (A) Atrophic beriberi (dry). (B) Edematous beriberi (wet) with pigmentation and erosions of the skin. (Hoffmann-La Roche, Inc.)

thiamine with other factors in proportion. (See Chap. 11 for recommended allowances of vitamins for different age and sex categories. See Chap. 8 for rich food sources of thiamine and other fractions of the B complex.)

PELLAGRA AND RELATED DEFICIENCIES

Incidence. Pellagra occurs primarily in semitropical countries such as Spain, Italy and southern United States. It is more prevalent among those whose food supply is limited in variety and in nutritive value. The incidence of severe cases of pellagra is less during periods of prosperity, and deaths from pellagra have dropped markedly in recent years since advanced cases are hospitalized and given effective treatment.

Etiology. Goldberger first demonstrated that pellagra was probably a vitamin deficiency. This vitamin, first called P-P (pellagra-preventive) by him, was later called vitamin B_2 or G. This factor as originally described proved to have several fractions, of which niacin seemed to be specific for human pellagra and for blacktongue in dogs. For some years previous both these conditions had been attributed to a similar deficiency, but it had not been identified. Earlier pellagra was thought to be due to a deficiency of protein or to an infection caused by eating spoiled corn.

All the symptoms of pellagra could not be accounted for by a niacin deficiency, nor could they be alleviated by niacin administration. Further investigation disclosed that there was usually a multiple deficiency of B complex factors, especially thiamine and riboflavin, which accounted for certain characteristic symptoms of the disease.

Still more recently investigators have been giving renewed attention to the old corn theory of the cause of pellagra, because the disease is more common among corn-eaters than others. Corn-fed animals show an increased susceptibility to niacin deficiency which has not yet been satisfactorily explained. Thus it appears that the liberal consumption of corn products, along with a deficiency of certain B complex factors in the diet of some poor whites and Negroes in the South, may have a bearing on the etiology of pellagra.

Symptoms and Pathology. Pellagra is characterized by skin lesions, gastro-intestinal disturbances and neurologic symptoms. The skin lesions are apt to be symmetrical on the exposed surfaces of arms, legs and neck. They may appear as the earliest manifestation of the disease and look at first like a severe sunburn, later becoming rough and scaly. Since exposure to sunlight aggravates not only the skin lesions but other symptoms as well, it is customary for pellagrins to protect themselves from such exposure. The pellagrous women in a Southern institution visited by the author were all wearing sunbonnets, long-sleeved cotton dresses and cotton gloves in hot summer weather.

Gastro-intestinal symptoms are usually alternate constipation and diarrhea with an accompanying stomatitis (sore mouth) and glossitis (sore tongue). Glossitis suggests the relationship to the disease blacktongue in dogs. Sometimes an anorexia (loss of appetite) or fear of food limits consumption and further aggravates the condition. A lack of hydrochloric acid in the stomach accounts for some of these symptoms and also predisposes the subject to anemia.

The neurologic manifestations may not be recognized early but may develop later into definite mental derangement. The lethargy characteristic of many of the victims may in itself be an early symptom of deficiency. That, combined with ignorance and poverty, has limited the introduction of adequate preventive measures in many areas. As a consequence there are still many cases of pellagra scattered through the South that are not receiving either prophylactic or curative treatment.

Treatment and Prevention. Severe cases of pellagra now are hospitalized if possible and given multiple-vitamin therapy plus an adequate diet, with the result that they recover in due course. Consequently, there has been a sharp drop in the number of deaths from pellagra in the last decade or two. The dosage of niacin and other B complex factors is usually well above the recommended allowance of 12 to 20 mg. of niacin daily and other factors in proportion. Niacinamide is the form in which this factor is administered when large doses are required. This derivative of niacin has the same curative effect but none of the disagreeable side reactions which sometimes result from large doses of niacin. Temporary hot flashes may result from therapeutic doses of niacin but seldom if ever from niacinamide. In any case, they are not serious and the excess of either form of niacin is excreted in the urine if not needed.

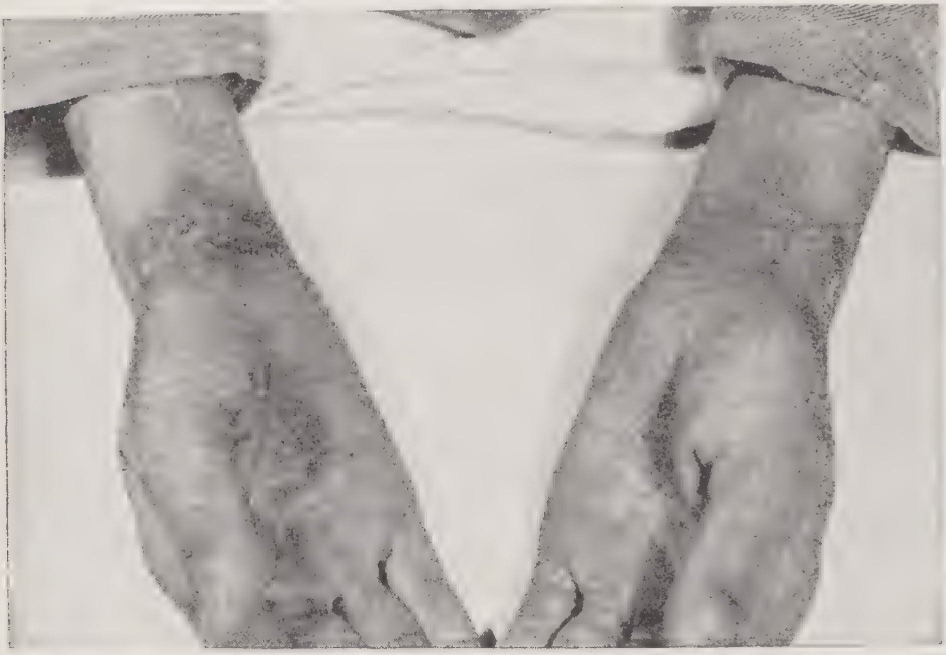

FIG. 59. Bilateral, symmetrical skin lesions with pigmentation due to niacin deficiency. (Youmans, J. B.: Diagnosis and Treatment of Nutritional Deficiencies, ed. 2, Philadelphia, Lippincott.)

Pellagrins with early and mild symptoms may never receive medical care or treatment and education in prevention is slow and often ineffective. Milk, eggs, meat, nuts and certain vegetables would supply the factors missing in the typical pellagra-producing diet of sorghum molasses, corn grits and fat back. A more varied diet is economically prohibitive among the lower-income groups. Nevertheless, educational efforts and other preventive measures among these people have been remarkably effective in reducing the number of cases of pellagra even in flood and in famine areas, but sporadic cases will continue to appear where poverty, isolation and ignorance exist. A Negro educator in talking to his people recommended:

A garden and a cow, a smoke-house and a sow,
Twenty-four chickens and a rooster, and you'll live better than you uster.

RIBOFLAVIN DEFICIENCY

Incidence. No well-defined deficiency syndrome or disease with a long history such as scurvy or beriberi is associated with a lack of riboflavin. However, studies by Spies *et al.*[6] show that riboflavin deficiency is one of the most common clinical nutrition problems, especially among infants and children in areas where other deficiencies are endemic. As has already been mentioned, this deficiency is often associated with that of niacin and thiamine as the cause of pellagra.

Symptoms and Pathology. Ocular symptoms which appear consistently may precede all other symptoms, with characteristic itching, burning, fatigue and eyestrain. Other clinical manifestations are a shiny red mucosa of the lips with cracking at the corners of the mouth, known as cheilosis, and roughened skin around the mouth and the nose often accompanied by sebaceous exudate.

Even before clinical symptoms appear a mild riboflavin deficiency may be responsible for a type of light sensitivity or twilight blindness, a condition which does not respond to vitamin A therapy, but does improve with the administration of riboflavin. The physiologic significance of riboflavin is discussed in more detail in Chapter 8.

Treatment and Prevention. Common food sources of riboflavin are listed in Chapter 8, but it is pertinent to emphasize that this factor is per-

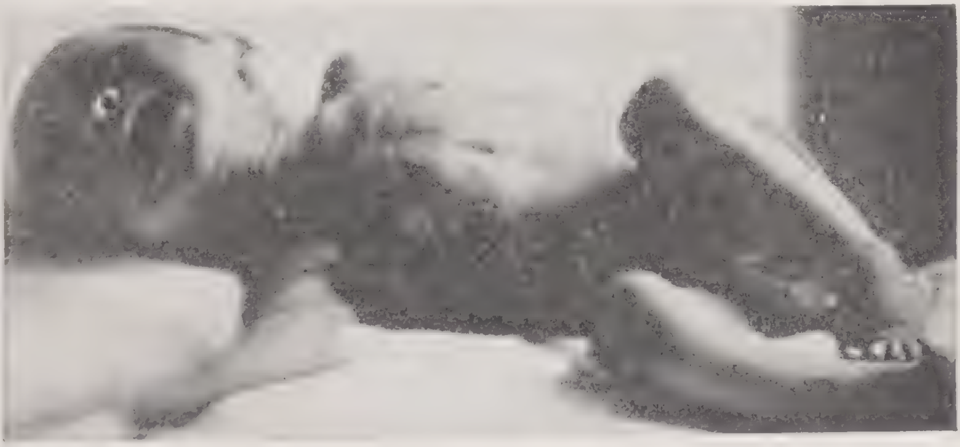

FIG. 60. Infantile scurvy. Typical contractions of extremities from pain. (Hoffmann-La Roche, Inc.)

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[6] Spies, T. D., *et al.*: Am. J. M. Sc. 200:25, 1940.

haps more difficult than other vitamins to obtain in adequate amounts in low-cost diets. Milk and organ meats are the richest natural sources. Enriched bread made with at least 6 per cent of dry-milk solids is also a good economical source. Dry brewer's-type yeast is rich in riboflavin and specially cultured strains are now being produced which yield more of this and other fractions of the B complex. Yeast products may find a wider use in the American diet when they can be manufactured with an acceptable flavor. Dry yeast, yeast extracts and other B complex concentrates are frequently prescribed by physicians if there is any indication that the diet cannot be made adequate.

Scurvy and Other Evidence of Ascorbic Acid Deficiency

History and Incidence. Scurvy is probably the oldest recognized deficiency disease. Although its specific relationship to ascorbic acid was not recognized until the twentieth century, its prevention by the use of fresh foods was practiced much earlier. Prevalent in Europe during the nineteenth century and earlier, scurvy was attributed for centuries to a limited food supply. On the long voyages which followed the discovery of America, sailors were often obliged to subsist for long periods on salt fish and meats, hardtack or other breadstuffs, entirely deprived of any fresh food. The outbreaks of scurvy on such voyages were frequently so severe that there was scarcely enough of the crew left to man the vessel. In 1772, however, Captain Cook took a voyage which lasted three years, during which time not one man was lost because of scurvy. This fact he attributed to the use of a "sweet wort" made from barley and sauerkraut. Subsequently, limes or lemons were included in the supplies, since they had been found to be antiscorbutic, i.e., scurvy preventives.

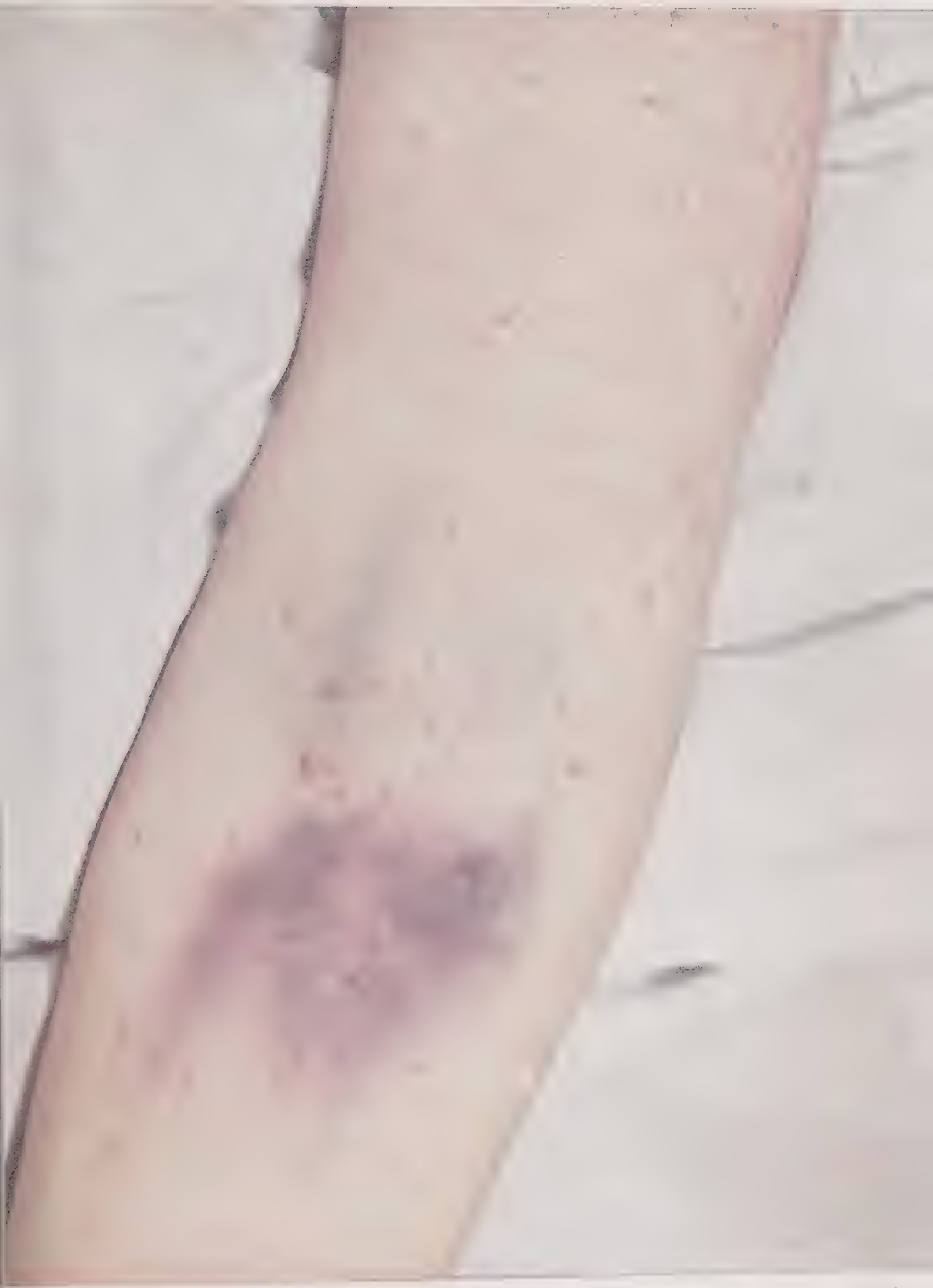
Later outbreaks of the disease have been associated with famine or war areas, when the food supply was limited. Its occurrence in recent years has been limited chiefly to polar expeditions or other circumstances where fresh-food supplies were unavailable. Expert dietetic advice was sought in planning the food supplies for the more recent polar expeditions in order to avoid the possibility of a vitamin C shortage, because scurvy is greatly dreaded by explorers.

Eskimos seldom have scurvy on their native diets but are susceptible to it when they adopt the "white man's diet." It is possible that their vitamin C intake may be greater or their requirement less on their native diet.

Scurvy is rare in the United States today, but milder manifestations of ascorbic acid deficiency do occur. It is difficult to estimate these early signs, such as described in the paragraph on symptoms; thus there are no figures as to the prevalence of so-called latent scurvy.

Etiology Clinical observations of scurvy in man and the experimental production of a similar disease in guinea pigs and in monkeys have definitely established that scurvy is a deficiency disease due to lack of ascorbic acid. When deprived of this vitamin, well-marked scurvy appears in about 2 weeks in guinea pigs and in about 4 months in man. This may account for the apparent seasonal variation when the disease manifests itself in the spring after a winter in which fresh foods were not available. There is probably a wide gap between the

PLATE I



Manifestations of ascorbic acid deficiency, petechial hemorrhages and bruising are result f increased capillary fragility. ("Therapeutic Notes," Parke, Davis & Co.)

amount of ascorbic acid necessary to prevent scurvy and the amount essential for optimum health.

Symptoms and Pathology. The principal symptoms of scurvy are restlessness, loss of appetite, soreness to the touch, sore mouth and gums with bleeding and loosening of the teeth, black-and-blue spots on the skin due to hemorrhages and swelling of the legs with special tenderness about the knee joints. Anemia may occur as a result of the loss of blood. Well-defined symptoms of this disease are seldom encountered in this country, but sallow skin, muddy complexion, lack of energy and fleeting pains in limbs and joints, so often noted in adolescence, may be due to a shortage of this vitamin. Scurvy in infants and in children is frequently diagnosed as infantile rheumatism, and the treatment, therefore, is quite ineffective. Irritability, retarded growth and tooth defects may also accompany this dietary deficiency.

Mild manifestations of ascorbic acid deficiency in adults may easily be overlooked or ignored. Tendency to bruise easily, slow healing of minor wounds and pin-point hemorrhages may be indications of tissue depletion of this factor. (See Fig. 60.)

Secondary and vague symptoms of ascorbic acid deficiency may accompany the well-defined syndrome of another disease. It is well recognized today that peptic-ulcer patients frequently have this complication because of self-imposed dietary restrictions of fresh fruits and vegetables. Recovery from surgery is hastened by the attention now given to ascorbic acid in preoperative and postoperative diets. High fever seems to create an increased demand for this factor. Although the reason for this increased requirement is still obscure, liberal supplements of ascorbic acid in concentrated form in addition to that in the diet may have significant influence on the rate of convalescence. There is considerable evidence, although it is not clear-cut, that ascorbic acid may increase the phagocytosis of the white blood cells when there is infection.

Treatment. An adequate supply of ascorbic acid is the obvious treatment for all these conditions, but what is an adequate supply? The recommended allowance of 70 to 75 mg. for normal adults is obviously not enough to saturate depleted tissues or to meet increased demands associated with fevers and infections. Ascorbic acid in tablet form is often prescribed in daily doses of 300 to 500 mg. for a short time during acute stages of disease or after surgery. The body excretes surplus ascorbic acid in the urine. Simple titration of a urine sample to determine the amount of ascorbic acid being discarded may show when large doses of this factor are no longer needed. It is harmless but futile to take more than the body can use.

Food sources of this factor are entirely adequate for the prevention of scorbutic symptoms or milder manifestations. For rich food sources of ascorbic acid and for a discussion of its properties and losses in cooking see Chapter 8. Ascorbic acid in tablet form is stable and relatively inexpensive. It is useful when fresh foods are not available or must be omitted from the diet for any reason. This concentrated form was used extensively during the war to promote wound healing and to act as a food supplement in emergency rations.

Rickets

Incidence and Etiology. The number and the severity of the cases of rickets have been greatly reduced in recent years, thanks to education and suitable prophylactic measures. Formerly the relatively high incidence of this disease among all classes of children in northern United States, Canada and northern Europe made it one of the deficiency diseases first to attract special attention. The general use today of adequate antirachitic supplements in infant feeding is chiefly responsible for the reduced incidence in northern climates. It is rare in our Southern states and in tropical countries in general, where children live more out of doors and have more skin exposed to the sun. Children of dark-skin races living in northern climates are even more susceptible to rickets than those of the white race. Figure 61 shows graphically why rickets is likely to be more prevalent in northern climates and in cities.

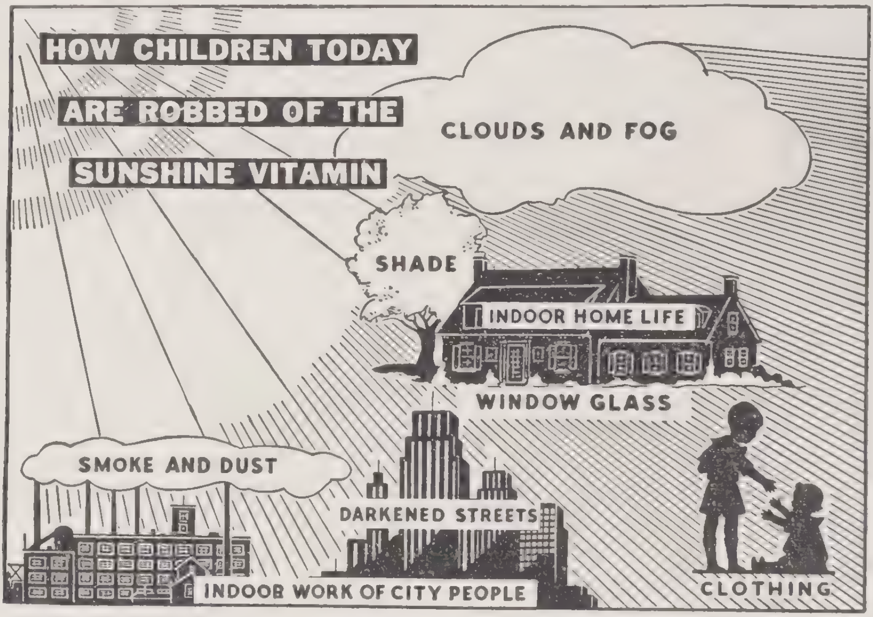


FIG. 61. Why we cannot get enough sunshine. (Wisconsin Alumni Research Foundation.)

Symptoms and Pathology. Rickets is a disease of infancy and early childhood in which the bones do not calcify properly as they grow. They become pliable, malformed and distorted, the result being such evident deformities as pigeon chest, enlarged wrists and ankles and bowed legs or knock-knees which result when the leg bones are not strong enough to support the child learning to walk. All these symptoms are pointed out in the schematic drawing of a child with rickets (Fig. 62), and several of the symptoms may be detected in the child with rickets pictured in Fig. 63. The enlargement or beading of the ribs, frequently called "the rachitic rosary," may be less evident in a plump infant than in an emaciated one, but it is a characteristic accompaniment of other deformities. Profuse sweating and restlessness are

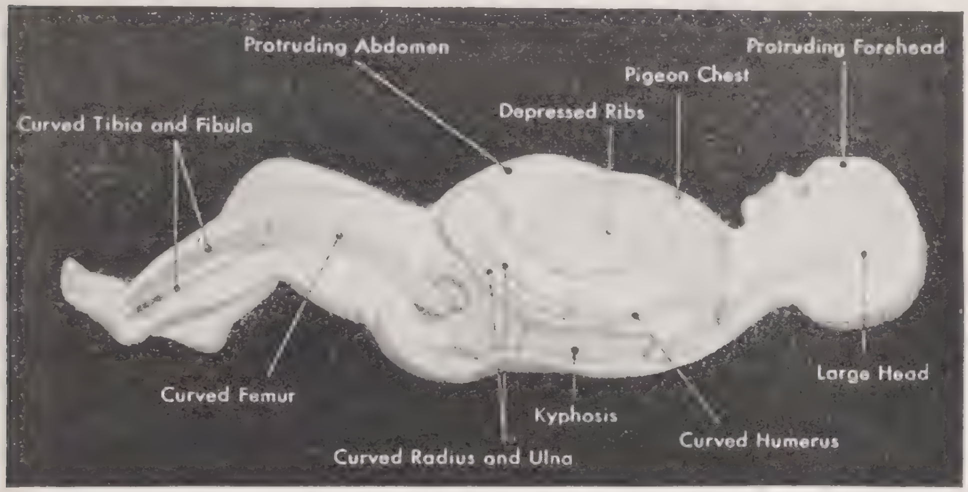


FIG. 62. The symptoms of rickets. (Abbott Laboratories.)

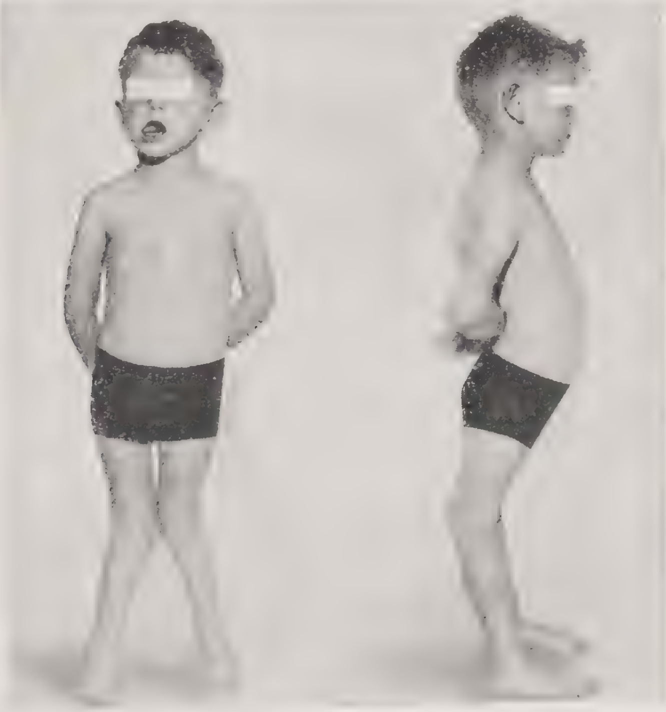


FIG. 63. Child suffering from severe rickets. Note knock-knees, flat feet, enlarged joints and other skeletal deformities accompanied by very poor posture. (Wisconsin Alumni Research Foundation.)

early symptoms of rickets in infants. Growth may not be retarded at first, since nature seems to allow the bones to increase in length to keep up with growth in other tissues, but their rigidity is decreased because there has not been a sufficient deposit of the stiffening material. Consequently, we may see the infant on the high-carbohydrate fattening diet looking plump and well nourished, although an x-ray reveals that the bones are not keeping pace with the growth of the body as a whole. When such children begin to walk they show the characteristic signs of rickets. Prolonged and severe cases usually show stunted growth. Since teeth consist of material similar to bone, a diet or other conditions unfavorable for building bone may lead to malformation of the teeth and predispose to dental caries. Infantile tetany may be associated with a low calcium type of rickets. Tetany is discussed in Chapter 32.

Treatment and Prevention. The major factors involved in the prevention of rickets—calcium, phosphorus and vitamin D—have been discussed in Chapters 7 and 8. The food sources of these minerals and supplementary sources of vitamin D have also been listed there.

The geographic incidence of rickets and practical experience indicate that it is more often a deficiency of vitamin D which causes rickets in children. Thus attention is directed to the problem of adequate and reliable sources of this factor in regions where sunshine cannot act as the natural preventive agent. Obviously, when children can be exposed to an adequate source of ultraviolet light (sunshine or ultraviolet lamp), sufficient vitamin D may be synthesized to regulate the utilization of minerals for bone building. This fact probably explains the low incidence of rickets in Southern states. However, the routine exposure of children to artificial sources of ultraviolet light is neither feasible nor economical. The food sources of vitamin D are so limited as to make it quite impossible to obtain enough antirachitic potency for curative purposes unless some supplementary source is provided.

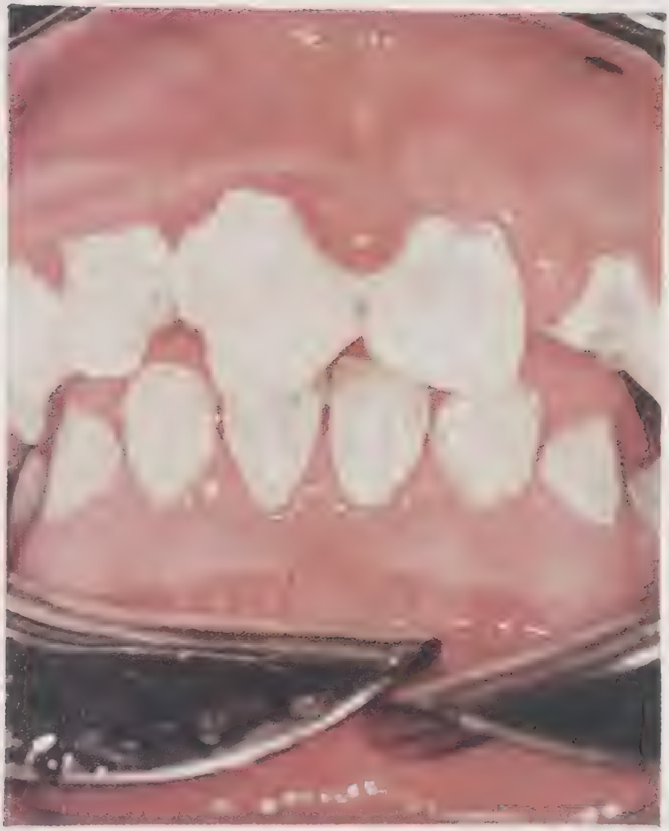
Cod-liver and other fish-liver oils are now standardized and labeled accurately as to vitamin D potency. Cod-liver oil is less concentrated and less expensive than most of the other more potent fish-liver oils, but the cost per unit of vitamin D should be compared when purchasing. Viosterol, a solution of vitamin D in oil, may be used upon the doctor's advice when a more concentrated source of vitamin D is desirable, but there is no vitamin A in viosterol as there is in the fish-liver-oil preparations.

The present popularity of vitamin D milk as a convenient and a reliable antirachitic agent for infants is well founded. There is a recognized need for extra vitamin D in the diet of infants and young children, even when they are not under a physician's care. Since milk contains the minerals calcium and phosphorus and it is a natural food for children, it seems to be the most suitable carrier for added vitamin D. Fortified evaporated milk is especially convenient for use in vicinities where fresh vitamin D milk is not available. (See Chap. 38.)

OSTEOMALACIA

Incidence and Pathology. Osteomalacia, sometimes called adult rickets, is characterized by poor calcification of bone and resulting deformities. It resembles rickets in certain symptoms but differs in etiology because it is a

PLATE II



Dental malocclusion following prolonged Vitamin D insufficiency in childhood. (Lederle Laboratories and Norman Jolliffe, M.D.)

degenerative change—a decalcification of bone already formed rather than faulty growth. The disease is most common in women during pregnancy and finds its highest incidence in the Orient among peoples subsisting largely upon cereals. This diet has a law calcium but high phosphorus content and is almost devoid of vitamin D. The disease is uncommon among people who have an abundance of food or among the poor who are field workers exposed to sunshine. It occurs among the poorer middle classes who have neither good food nor sunshine.

Treatment and Prevention. Dietary histories of cases of osteomalacia almost always disclose multiple deficiencies. Diet for such persons must be adequate in all respects, special attention being paid to a liberal amount of good-quality protein as well as the bone-building minerals and vitamin D. Milk, milk products, meat, eggs and legumes are both preventive and curative. Fish-liver oil or other concentrates of vitamins A and D are usually prescribed along with a good diet.

DENTAL CARIES

Incidence. Contrary to the endemic or regional incidence of some other deficiencies, dental caries is so common that there will be few readers who have not experienced it themselves. It is rare indeed to find adults with absolutely perfect teeth. Figures on incidence of dental caries among population groups do vary according to locality, but they are higher than for any other disease discussed in this chapter. Authorities estimate that only 2 per cent of the people in the United States have entirely escaped having at least one dental cavity.

Etiology. Dental caries has been variously attributed to inheritance, metabolic disturbances, specific or multiple food deficiencies, local conditions in the mouth, including composition of saliva, and lack of fluorine in the water supply. None of these entirely explains the high incidence or varying degree of susceptibility to caries encountered among children of the same family with similar dietary and mouth-hygiene habits.

Prophylaxis. The confusion which still exists concerning the role of diet in dental caries is reflected in the following paragraphs which give a brief review of several widely accepted theories.

Whether the action is local, systemic, or both, the fact remains that a diet liberal in fruits, vegetables and milk is less likely to promote dental caries than is one high in cakes, cookies and candy. It is especially recommended that some raw fruit or vegetable be eaten at the end of each meal rather than the usual concentrated sweet dessert. The group of investigators who consider that the regular intake of a well-balanced diet is of major importance argue that such a diet maintains high general resistance of body tissues. It is a difficult theory to prove but a practical one to follow until further research indicates the specific factors involved. The important role of calcium and phosphorus in the formation and the growth of sound teeth is generally accepted, and these same minerals probably help in maintaining healthy teeth, even in adults according to evidence of research with "tagged" calcium.

Closely related to the preceding is the theory that erupted teeth behave like bone in many respects, and that an abnormal calcium-phosphorus metabolism or a vitamin D deficiency predisposes that individual to dental decay. Such deficiencies during or preceding the eruption of the teeth undoubtedly account for some faults in structure, but whether they are a cause of dental caries is an open question, although a comparison of comparable groups of children (economic status, race) shows considerably less caries in the Southern group where the vitamin D effect of sunlight is greater; and it has been shown that the higher incidence of caries in winter when the sunlight is less effective made be offset by vitamin D additions to the diet or by ultraviolet-light treatment.

Another group of workers places great emphasis on the regular and the liberal intake of vitamin C as part of an otherwise well-balanced diet to prevent deterioration of dentin and pulp with subsequent increase in susceptibility to decay. Experiments with animals show that a lack of vitamin C affects the gums and predisposes to mouth infections. Loosening of the teeth is a recognized accompaniment of advanced scurvy. The intake of vitamin A has also been emphasized by other investigators.

A large group believes that the initial process of tooth decay is brought about by the action of acid on the surface of the teeth. There is evidence that this acid is formed on the protected areas of the teeth by the growth of micro-organisms, such as Lactobacillus acidophilus, which are capable of fermenting carbohydrate to form lactic acid. Carbohydrate foods of such consistency that particles lodge in the crevices of the teeth furnish a favorable medium for the growth of such acid-producing bacteria. Lowered incidence of caries in children has been observed repeatedly when the intake of artificially sweetened foods was restricted and the use of natural fruits was encouraged; and, contrariwise, caries has been shown to increase in children when sugars and pastries were added to their diet under controlled conditions (orphanages). The cleaning action on the teeth of raw fruits and vegetables is well recognized.

The number of acidophilus organisms has been shown to parallel the degree of caries present, but this may indicate favorable conditions for their growth rather than their causal character. Deep penetration of tooth substance by streptococci may be more important as causal factors of decay.

Recent evidence of the close correlation of the incidence of dental caries and the fluorine content of the water supply has given impetus to the use of fluorine as a prophylactic agent. One report[7] compares the incidence of caries among some 2,832 children in 8 Illinois towns in which the fluorine content of the water varied from 0 to 1.8 p.p.m. This report shows an inverse ratio of caries to fluorine. With fluorine-free water caries was three times as prevalent as in the highest fluorine towns (1.8 p.p.m.). Considering the number of tooth surfaces susceptible to decay the incidence was fourteen times as great. Mottled enamel is likely to occur where fluorine in the water exceeds 2 p.p.m. (See Chap. 7 for a more detailed discussion of fluorine.)

HEMORRHAGIC DISEASE OF INFANTS

Incidence and Etiology. The discovery that vitamin K would prevent the often fatal hemorrhagic disease of newborn infants adds one more to the list of deficiency diseases. The deficiency is uncommon in adults, except when a lack of bile flow into the intestinal tract interferes with absorption of this factor from foods.

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[7] Dean, H. T., *et al.:* Pub. Health Rep. 56:761, 1941.

The use of mineral oil over extended periods has been known to deplete the body of vitamin K to the extent of causing a manifest deficiency in both mother and infant.

Pathology. The slow clotting time of the blood characteristic of this condition is due to too little prothrombin, the clotting agent in the blood. Vitamin K (Koagulationsvitamin) was first shown to hasten the clotting time in chicks and subsequently was tried successfully in similar clinical conditions where slow clotting time was the cause of hemorrhages.

Treatment. The prophylactic use of vitamin K concentrates in the prevention of hemorrhagic disease in infants and also of hemorrhages at parturition is now common practice among physicians. Vitamin K is usually given in tablet form to the mother shortly before delivery and one dose of 1 or 2 mg. is administered intravenously to the infant very soon after birth. Food sources of this factor are adequate for most people. (See Chap. 8.)

NUTRITIONAL ANEMIA

Anemias may be caused by nutritional deficiencies, metabolic disturbances or loss of blood by hemorrhage. Only the first type may rightly be considered a true deficiency; the others might be called conditioned malnutrition. Anemia may occur secondary to general malnutrition and other deficiency diseases (see sprue, pellagra, scurvy and hemorrhagic disease of infants in this chapter). Nutritional anemia was formerly associated chiefly with iron deficiency, but now it is recognized that possibly protein and vitamins A and C may be involved quite as often. The iron story is discussed more fully in Chapter 7.

Anemia is far more common among females than males and occurs when requirements are greatest and the drain upon stores of iron and other necessary factors are heaviest, i.e., during adolescence, pregnancy and following hemorrhage or wasting disease. Infants of either sex may develop anemia as a result of poor prenatal nutrition or insufficient food supplements during the nursing period. (See Chap. 31, Diseases of the Blood.)

SIMPLE OR ENDEMIC GOITER

Common or simple goiter is usually attributed to an iodine deficiency in food. Since iodine in surface soil shows a very uneven distribution and since plants absorb iodine from the soil, the iodine content of foodstuffs varies with the locality in which they are grown. Thus we find simple goiter most common in those parts of the world where the surface soil is low in iodine. Due to increased facilities for food distribution in the United States today, city people are less confined to food grown in one locality and the incidence of simple goiter seems to be decreasing. Iodized salt which is on the market in most goitrous regions has also proved beneficial in reducing the amount of goiter, as evidenced by examination of school children. In one state in which goiter was almost eliminated, it again became more prevalent when the regulations concerning iodized salt were lifted. If the spectacular decrease in the incidence of goiter which resulted from the use of iodized salt is to continue, more publicity must be given to it and its use in goitrous sections of the country encouraged. (See Chap. 7, Iodine, and Chap. 33, Hypothyroidism.)

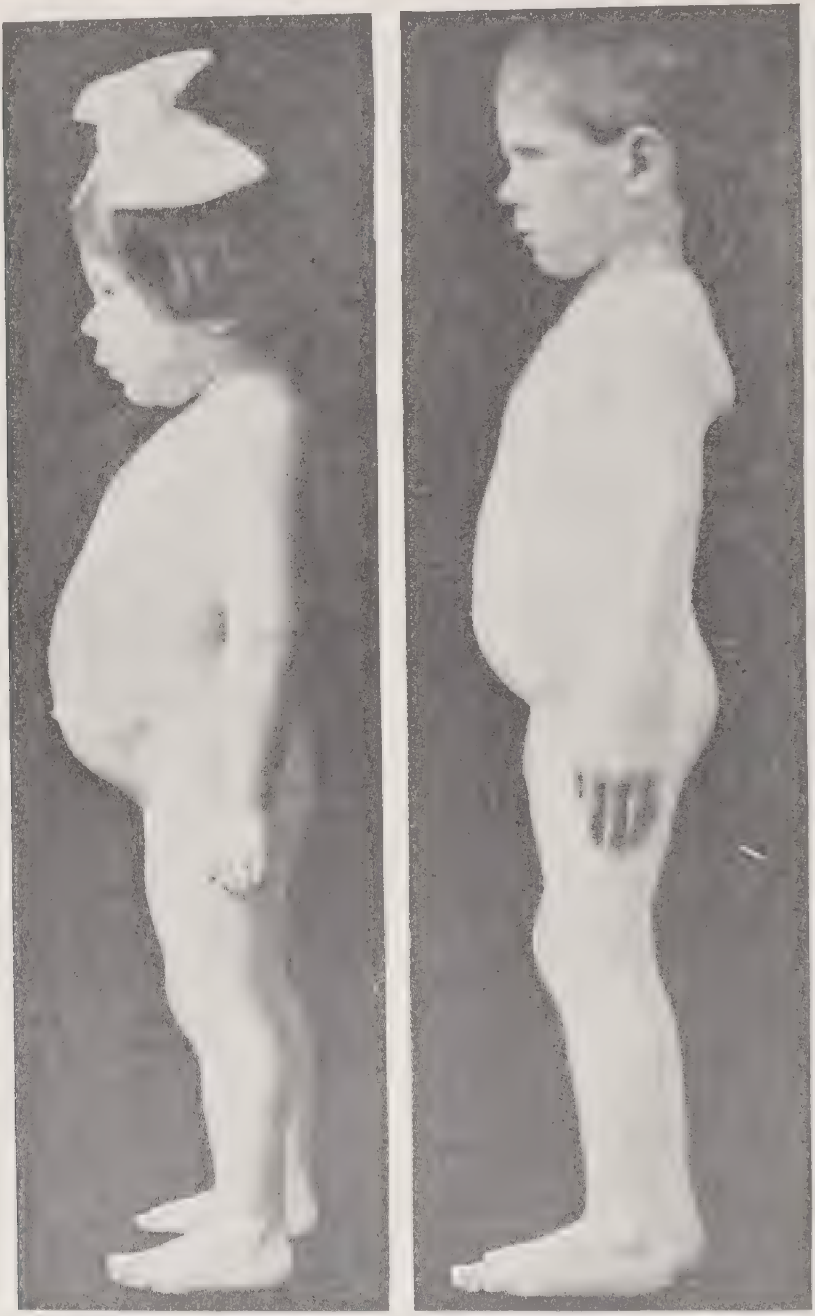

FIG. 64. Iodine deficiency in childhood and corrective effect of thyroid extract. The photographs were taken at the time treatment was begun and one year later. There was an increase of 6 inches in height during this period. (E. C. Kendall, Harvey Lectures, Lippincott.)

EARLY DIAGNOSIS AND TREATMENT OF NUTRITIONAL FAILURE

Mild forms of deficiency diseases which are not usually recognized as clinical entities seldom come to the attention of the general practitioner unless more serious conditions develop, nor has the physician had any adequate criteria for recognizing these early signs. The insidious development and the delayed clinical evidence of malnutrition make the problem none the less serious. This subject is of great concern to nutritionists, public-health nurses and others who frequently are in closer contact than physicians with children and with families living on low incomes and an inadequate food supply. There is an open field for further study and observation of these deficiency states among all groups of the population, but especially among the lower-income groups, in which the vicious circle of malnutrition, lack of strength and ambition and continued low income offers little opportunity for real improvement.

A committee report[8] from the National Research Council on the recognition of early nutritional failure is a definite start in the right direction. This listing of signs and symptoms of early deficiency states takes account of the fact that parents, teachers, nutritionists and nurses may detect these signs and draw the physician's attention to them. In spite of difficulties

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[8] Subcommittee on Medical Nutrition, Division of Medical Sciences, National Research Council, J.A.M.A. **118**:615, 1942.

SYMPTOMS AND SIGNS SUGGESTIVE OF EARLY DEFICIENCY STATES IN INFANTS AND CHILDREN

	Symptoms	
1.	Lack of appetite	(L)
2.	Failure to eat adequate breakfast	(L)
3.	Failure to gain steadily in weight	(L)
4.	Late period of sitting, standing, walking	(N)
5.	Aversion to normal play	(L)
6.	Chronic diarrhea	(L)
7.	Inability to sit	(L)
8.	Pain on sitting and standing	(L)
9.	Poor sleeping habits	(L)
10.	Backwardness in school	(L)
11.	Repeated respiratory infections	(L)
12.	Abnormal intolerance of light, photophobia	(L)
13.	Abnormal discharge of tears	(L)

	Physical Signs	
1.	Lack of subcutaneous fat	(N)
2.	Wrinkling of skin on light stroking	(N)
3.	Poor muscle tone	(D)
4.	Pallor	(N)
5.	Rough skin (toad skin)	(N)
6.	Hemorrhage of newborn (vitamin K deficiency)	(D)
7.	Bad posture	(L)
8.	Nasal blackheads and whiteheads	(N)
9.	Sores at angles of mouth, cheilosis	(L)
10.	Rapid heart	(N)
11.	Red tongue	(D)
12.	Square head, wrists enlarged, rib beading	(N)
13.	Vincent's angina, thrush	(D)
14.	Serious dental abnormalities	(N)
15.	Corneal and conjunctival changes—slit lamp	(D)

L, those which parents or teachers might observe.

N, those which nutritionists or nurses might observe.

D, those which physicians only would be expected to observe. The physician would take into account all other symptoms, whether or not they had been previously observed.

SUMMARY OF DEFICIENCY DISEASES

Name	Deficiency	Symptoms and Pathology	Incidence
Starvation, edema, hypoproteinemia	Amount of food, protein foods	Edema shifting with posture, pot belly, weakness, lassitude, mental depression	In war and famine areas
Night blindness, glare blindness	Vitamin A, mild deficiency	Poor adaptation to dull light after exposure to bright light. Slow regeneration of visual purple	Adults and children
Xerosis	Vitamin A, mild deficiency	Inflammation and redness of lids, photophobia, itching, burning	Lower-income groups anywhere
Xerophthalmia (conjunctivitis)	Vitamin A, severe deficiency	Drying of cornea, secondary infection, rapid destruction of eye, blindness	Infants more than adults
Beriberi, wet or dry (polyneuritis)	Thiamine, severe deficiency Mild deficiency	Chronic constipation, neuritis, paralysis of lower extremities, with or without edema Muscular and nervous fatigue	In the Orient and Labrador; men more than women
Pellagra	Niacin Thiamine Riboflavin	Symmetrical skin lesions Gastro-intestinal disturbances Neurologic symptoms	Southern U.S.A. Southern Europe (corn eaters)
(No specific term)	Riboflavin	Eyestrain, fatigue and burning; cheilosis, cracks at corner of mouth	Adults or children
Scurvy	Ascorbic acid	Hemorrhages in joints, spongy gums, easy bruising, painful joints	Mariners, explorers and those in famine areas
Rickets	Vitamin D Calcium Phosphorus	Legs bowed or knock-kneed, enlarged wrists and ankles, pigeon chest, pot belly, square head, beaded ribs	Infants and children under 3; northern climates, little sunshine
Osteomalacia, "adult rickets"	Vitamin D (possibly) Calcium (possibly)	Decalcification of bone and resulting deformities	Pregnant women in Orient, low income
Dental caries	Calcium Vitamins C or D (possibly) Fluorine	Cavities in teeth, tendency to decay	Most widespread sign of malnutrition in adults and children
Hemorrhagic disease of infants	Vitamin K	Slow clotting time of blood, due to deficiency of prothrombin	Newborn infants

SUMMARY OF DEFICIENCY DISEASES (*Continued*)

Name	Deficiency	Symptoms and Pathology	Incidence
Nutritional anemia	Iron, protein, vitamins A or C	Low hemoglobin and red cell count, fatigue, lassitude, paleness and listlessness	Adolescent girls, pregnant women and infants
Common goiter	Iodine	Enlarged thyroid, low metabolism, obesity, dulled mentality in children	Great Lakes states and Northwest; females more than males

due to inadequate clinical and chemical methods for accurate diagnosis, the committee felt that certain clinical criteria presently available were sufficient to warrant more extensive surveys than have as yet been made. The original publication gives a list of similar signs and symptoms for adolescents and adults and paragraphs of explanation.

The wide variation in estimates of the prevalence of malnutrition in the United States prompted the Food and Nutrition Board to undertake a reevaluation of such reports. The reason for the variation in estimates was that "some types of malnutrition are strikingly obvious to everyone, some are apparent only to the physician who looks for them, and some are vague and elusive even to the careful observer using the most accurate specialized technics. If the first group alone is counted the prevalence is recorded as low, almost negligible. If the second group is counted it will be recorded as high. If the third group is included, then the rate will be sufficiently high to occasion genuine concern."[9] They further conclude that dietary inadequacies and malnutrition are of frequent occurrence in the United States.

The complete report of the Committee on Diagnosis and Pathology of Nutritional Deficiencies published in bulletin form[10] has been referred to in Chapter 2 in pointing out continued room for improvement. It is pertinent to comment here that the committee expressed the need for new diagnostic methods and the dissemination of such information by means of a handbook, training centers and courses in medical schools. It will also be necessary to define what degree of malnutrition should be recorded.

Recognizing the need for more experience in judging nutritional status by clinical signs, the National Research Council sponsored a Medical Survey of Nutrition in Newfoundland, where nutritional deficiencies of several types are common. The technics used in such a rapid survey of population groups were reported[11] in detail with colored plates of eye, mouth and skin conditions indicative of deficiencies. All these steps are in the right direction, but there is still need for a handbook on early diagnosis and treatment of nutritional failure.

[9] Jolliffe, N., J. S. McLester and H. C. Sherman: J.A.M.A. **118**:944, 1942.

[10] Food and Nutrition Board, Inadequate Diets and Nutrition Deficiencies in the United States, Bulletin 109, Nov., 1943.

[11] Medical Survey of Nutrition in Newfoundland, Canad. M.A.J. **52**:227, 1945.

REVIEW QUESTIONS

1. When near-starvation conditions bring multiple deficiencies, which ones are apt to show up first and what should be the emphasis of relief feeding in order to do the most good for the greatest number of people?

2. If you were working in southern Italy and encountered children who had pot bellies and were listless and inactive, would you suspect rickets or some other deficiency, and why?

3. Whenever there are food shortages or nutritional deficiencies the susceptibility to them varies with age and sex. Which deficiencies are more apt to show up in children and which in adults? How will symptoms of the same deficiency vary with age or sex?

4. Is there any evidence that education with a view to better nutrition of children during the past few decades has reduced certain deficiency diseases? If so, which ones?

5. Skin lesions and gastro-intestinal disturbances are symptoms of a deficiency disease which occurs in low-income families in our Southern states. What specific deficiencies and food habits predispose to this condition and what is it called?

6. Families of fishermen in Labrador suffer from chronic constipation and some people become partially paralyzed during the winter months. What deficiency is probably involved, and which members of the family are apt to show the paralysis first?

7. If dental caries was conspicuously less in children of a given community than in surrounding areas, what would you suspect as the protective factor, and why?

8. If an infant is irritable, cries when handled and shows red, inflamed gums, what deficiency would you suspect and how would you supply the missing factor?

9. Two well-known clinical syndromes have recently been added to the list of so-called deficiency diseases. What are they and what factors relieve symptoms?

10. Mild forms of deficiency diseases undoubtedly occur more often than is known. Why are they not diagnosed earlier? What progress has been made toward earlier recognition of nutritional failure?

23

Diabetes Mellitus

Chapter Topics

- INTRODUCTION
- CAUSES OF DIABETES
- SYMPTOMS
- DIAGNOSTIC TESTS
  - SPECIFIC GRAVITY OF THE URINE
  - SUGAR IN THE URINE
  - KETONE BODIES IN THE URINE
  - BLOOD-SUGAR TEST
  - DIETARY TESTS
    - TESTING THE CARBOHYDRATE TOLERANCE
- PHYSIOLOGIC EXPLANATION OF BODY CHANGES
  - HOW GLUCOSE GETS INTO THE BLOOD AND THE URINE
  - HOW KETONE BODIES GET INTO THE BLOOD AND THE URINE
- DIET THERAPY
  - DIETARY PRESCRIPTIONS
  - PLANNING AND CALCULATING THE DIET
- INSULIN THERAPY
  - CRYSTALLINE ZINC INSULIN
  - PROTAMINE ZINC INSULIN
  - GLOBIN INSULIN
  - INSULIN ADMINISTRATION
- DIABETIC EMERGENCIES
  - COMA
  - INSULIN REACTIONS
  - SURGERY
- DIABETES IN CHILDREN
- DIABETES AND PREGNANCY
- TEACHING THE PATIENT

INTRODUCTION

Diabetes mellitus, or sugar diabetes, is a chronic disease concerned with carbohydrate metabolism in which the whole endocrine system is involved, and particularly the pancreas, which supplies the body cells with the necessary insulin for metabolizing the carbohydrate glucose. This disturbance results in partial or complete inability of the body to utilize carbohydrate normally. The carbohydrate which is not burned accumulates in the blood stream, a condition known as hyperglycemia, and is later excreted in the urine. Sugar in the urine is known as glycosuria.

It will be remembered that the pancreas plays an important role in the process of digestion. It produces an external secretion known as pancreatic juice and an internal secretion known as insulin. The external secretion aids in the digestion of protein, fat and carbohydrate in the intestine. The internal secretion is the principal factor in the utilization of carbohydrate by the body cells. The insulin is secreted by special cells of the pancreas which are arranged in clusters known as the islands of Langerhans.

CAUSES OF DIABETES

Predisposing Causes. Just what produces diabetes is not definitely known, but there is a strong hereditary tendency. The disease "runs in families." It also seems to afflict certain races, particularly the Jewish race, more than others. Contributing causes may be worry, a sedentary life, bad food habits and obesity. Joslin[1] is confident that overeating resulting in obesity is one of the chief predisposing causes of this disease. He found upon reviewing a thousand cases that only 10 per cent of them were underweight, and that 75 per cent were above the normal weight zone. He found that persons 21 per cent or more overweight developed the disease 79 times as frequently as those 21 per cent underweight. Diabetes is primarily a disease of old age, as its greatest incidence is between 50 and 70 years of age. It does, however, affect people of all ages, even young children. The younger the patient the more serious the disease. In elderly people it is usually a mild condition, associated with arteriosclerosis or some other old-age phenomenon. The onset of this disease is generally slow and insidious, but it may be sudden.

SYMPTOMS

The symptoms which disturb the patient and send him to the doctor are:

1. Frequent and copious urination, known medically as polyuria.
2. Extreme thirst, known as polydipsia.
3. Dehydration, due to polyuria.
4. Excessive hunger, known as polyphagia.
5. Loss of strength.
6. Loss of weight.

Upon arrival at the doctor's office a patient with the foregoing symptoms will usually have a blood and urine analysis for sugar. In all probability he will be found to show:

7. Sugar in the urine.
8. Increased sugar in the blood.

The history of the case will probably show:

9. An increased susceptibility to infection, and a physical examination may reveal a gangrenous lesion.

If the patient is sufficiently ill to require emergency treatment, one may suspect:

10. Ketosis or acidosis.
11. Coma, a state of unconsciousness of most serious consequence, or
12. Insulin shock.

DIAGNOSTIC TESTS

The laboratory findings are always the determining factors in the diagnosis of diabetes. The examination of the urine includes tests for:

1. Volume.
2. Specific gravity.
3. Glucose.
4. Ketone bodies.

The normal volume excreted daily varies, of course, with the amount of fluids consumed and the amount lost through evaporation or perspiration. The normal limits, however, lie roughly between 1,200 cc. and 2,000 cc. (1-2 quarts) for a 24-hour period. If sugar is present, the volume is usually increased; the total volume often exceeds 3,000 cc. in severe cases. Joslin reports a case which excreted more than 7,000 cc. in 24 hours.

Specific Gravity of the Urine

Specific gravity is a number which expresses how much heavier a given substance is than an equal volume of some standard substance—usually water or air. A substance with a specific gravity of 1.015 is just 1½ per cent heavier than water. The specific gravity of urine varies within normal limits from 1.008 to 1.030. The solids in solution are chiefly urea and salts; and in diseases of the kidneys, albumin and glucose. In an effort to maintain a normal concentration of soluble constituents in blood and tissue cells, the body excretes a large volume of urine, which is made possible by the increased thirst followed by increased drinking. When large quantities of sugar are excreted, the weight or specific gravity of the urine is usually increased above 1.030. The total volume is also increased.

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[1] Joslin, Elliott P.: A Diabetic Manual, Philadelphia, Lea, 1941

Sugar in the Urine

Sugar in the urine, except when found in mere traces, is strongly indicative of diabetes mellitus, although there are a few exceptions. These include renal glycosuria, when the renal threshold for glucose is lowered; alimentary glycosuria, when too much sugar has been ingested at one time for the liver to store the excess; pentosuria, when the body fails to oxidize a certain carbohydrate called pentose; fructosuria, when fructose is not utilized, and lactosuria in nursing mothers, when lactose is not used. For more specific details concerning the tests when diabetes mellitus is suspected, see Special Tests, Part Four.

Ketone Bodies in the Urine

Certain fatty acids may appear in the urine as the result of incomplete burning of the fats. The presence of these fatty acids, known also as ketone bodies, is indicative of a serious condition known as ketosis, or diabetic acidosis, which, if not corrected, may result in coma.

Blood-Sugar Test

The presence of glucose in the urine is strongly suggestive of diabetes mellitus, but a blood-sugar examination is necessary to make the diagnosis certain. This test is made after a 12-hour fast. When this test is not conclusive, a glucose tolerance test on the blood should be made. The latter test is carried out by giving a known amount of glucose in proportion to the body weight after a night fast. The blood sugar is examined before the glucose is given and again in ½ hour, 1 hour and 2 hours after the glucose is taken. In some conditions it is necessary to continue this test at hourly intervals for as much as 6 hours. Note the difference in the glucose tolerance curve between a normal person and a diabetic. (See Fig. 65.)

Dietary Tests

Testing the Carbohydrate Tolerance

The glucose tolerance is defined as the difference between the glucose equivalent of the diet and the glucose excreted in the urine.

The capacity for burning glucose is known as the patient's carbohydrate tolerance. To determine this in a patient without ketosis, a calculated weighted diet of known composition, usually low in both carbohydrate and calories, is given, following which analyses are made. If the urine is sugar-free, it is an indication that the patient may be able to burn more carbohydrate and another diet with increased carbohydrate and calories is tried. This diet is continued or increased cautiously unless sugar again appears, when it is evident that the patient's tolerance has been exceeded and in all probability his standard diet will be based on the carbohydrate value of the diet used prior to the appearance of urinary sugar. This amount, if much below normal, will probably be increased somewhat by the use of insulin, as described later in this chapter.

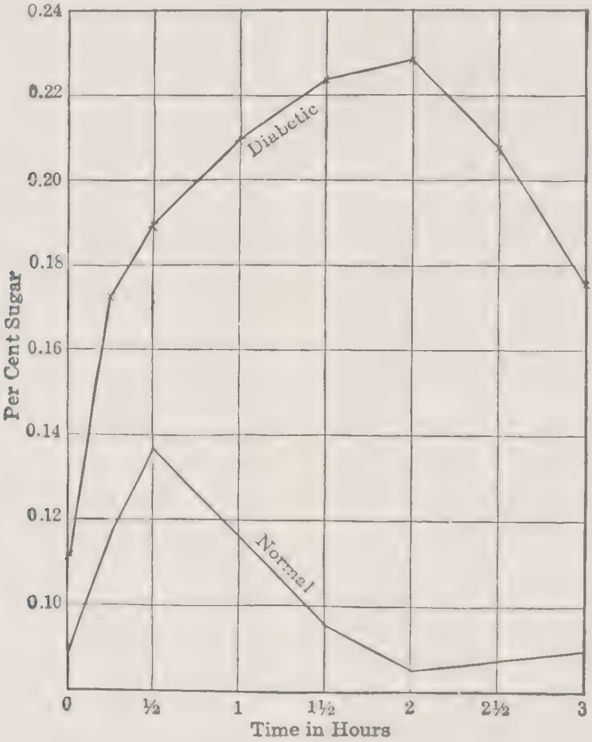

Fig. 65. Glucose tolerance curve in the case of a normal and a diabetic individual. Ordinates = per cent sugar, abscissas = time after the ingestion of 100 Gm. of glucose. (Bodansky: Introduction to Physiological Chemistry, New York, Wiley.)

PHYSIOLOGIC EXPLANATION OF BODY CHANGES

How Glucose Gets into the Blood and the Urine

Glucose and Glycogen. Carbohydrates such as starch, cane sugar (sucrose) and milk sugar (lactose) enter the body as food. After being acted upon by the saliva, the pancreatic and the intestinal juices, they are changed to so-called monosaccharides, or simple sugars, that pass readily through the intestinal walls into the blood stream and soon reach the liver through the portal circulation. The principal sugar formed is glucose, although there may be some fructose and galactose, both of which are transformed into glycogen when they reach the liver, as already stated in Chapter 3. The liver then allows a portion of this glycogen, converted to glucose, to pass into the blood stream to maintain the normal blood-sugar level and to be carried to the tissues as rapidly as there is need for it, either for heat or muscular activity, or to be stored as muscle glycogen. Thus the liver, in some way not definitely known, functions to maintain the blood sugar at its normal level of approximately 0.1 per cent or, as sometimes expressed, 100 milligrams per 100 cc. of blood. Insulin, the internal secretion of the pancreas, is one of the controlling factors in this regulatory action, including (1) the conversion of glucose to glycogen, the change back to glucose and its release to the tissues, and (2) its utilization by the tissues.

Insulin Deficiency. When disease interferes with regular production of insulin this control of the blood-sugar level is lost and the glucose is allowed to pass directly into the blood stream instead of being stored as glycogen in the liver or in the muscles. Consequently, the blood sugar rises, but, since it is excess material, some means for disposing of it must be found. When it reaches the level of 0.16 to 0.18 per cent known as the renal threshold, sugar is excreted by the kidneys and appears in the urine. The tissues also become flooded with glucose and may fail to function normally.

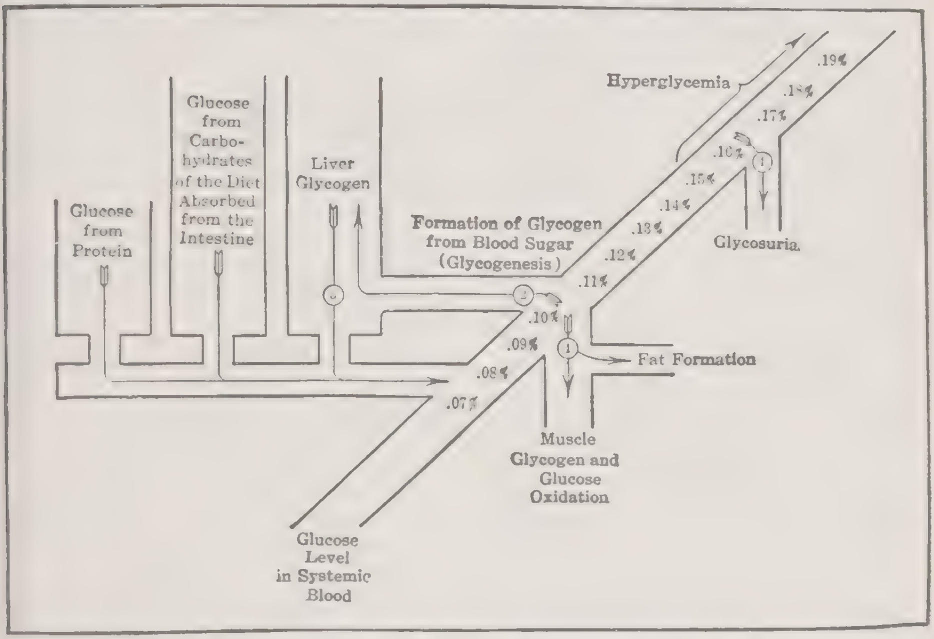
Glucose from Protein
Glucose from Carbohydrates of the Diet Absorbed from the Intestine
Liver Glycogen
Formation of Glycogen from Blood Sugar (Glycogenesis)
Hyperglycemia
Glycosuria
Fat Formation
Muscle Glycogen and Glucose Oxidation
Glucose Level in Systemic Blood
.07%
.08%
.09%
.10%
.11%
.12%
.13%
.14%
.15%
.16%
.17%
.18%
.19%
1
2
3

Fig. 66. Schematic illustration of some of the factors which regulate the sugar concentration of the blood. (1) and (2) under control of insulin and other hormones; (3) under control of sympathetic nervous system and adrenalin; (4) regulated by renal threshold. (Bodansky: Introduction to Physiological Chemistry, New York, Wiley. After Ringer and Baumann, with modifications. Barker, L. F.: Endocrinology and Metabolism, New York, Appleton-Century.)

Mechanisms of Carbohydrate Metabolism. The mechanisms by which the body attempts to control the carbohydrate metabolism may be likened to a great mountain stream controlled by dams and reservoirs. The first dam is probably the insulin which, through its control, causes the reservoir, the liver, to be filled with glycogen. When, for any reason, this reservoir is broken down, the stream below is flooded and the second dam, the kidneys, attempts to hold it in check. When it reaches a certain level there, it again overflows and in all probability will spread to the fields beyond, which, according to the simile, represent the tissues of the body. Just as the fields require moisture, so do the tissues require glucose, but an overabundance or flooding in either case is detrimental.

The kidneys are also the sluice-way which eventually allows for an overflow into the urine when the flood level of sugar reaches the critical level. The original source of the sugar as it appears in both the blood and the urine is, as stated, the food supply. Of course, it comes chiefly from the carbohydrates—starch and the various sugars; but it is interesting to know that each of the other food constituents—protein and fat—contributes to this supply also. When the proteins are digested and converted into amino acids, they too find their way to the liver, where they are allowed to pass through to the tissues if needed for repair or growth. If not in demand for immediate use, they are deaminized, as stated in Chapter 5. The nitrogenous portion is eliminated, while the glucose portion of the remainder is stored like any other carbohydrate. While there is some difference in the various kinds of protein as to the per cent of glucose which each yields, the average is 58 per cent of the total weight of protein.

Likewise, when the fats are digested, fatty acids and glycerol are produced. The glycerol is converted into glucose and stored by the liver, just as carbohydrates from any other source are used. Theoretically at least, all fats yield about 10 per cent glucose.

There are, therefore, three sources of glucose from which blood sugar may be derived. They are

	Per Cent
Carbohydrates	100
Protein	58
Fats	10

The total glucose in a day's diet may therefore be expressed by the following formula: $G = 100\%\ C + 58\%\ P + 10\%\ F$.

During fasting or starvation or an insufficient food supply, the body protein and fat serve as sources of carbohydrate, though in insufficient amounts to constitute a normal supply.

How Ketone Bodies Get into the Blood and the Urine

The fatty acids from which ketone or acetone bodies may be formed find their way into the blood stream in much the same way that an excess of glucose enters. Like glucose, only small amounts of fatty acids occur in normal blood and urine. Normal blood contains about 0.00001 per cent or 1 mg. in 100 cc. In diabetic conditions there may be 200 to 300 times this amount. Ketone bodies are the products of incompletely burned fats and fatty acids which are derived chiefly from (1) food fats and (2) body fats. A third source may be proteins, as some of the amino acids derived either from food sources or from body protein are capable of being converted into ketone products.

Body fats are oxidized only when the supply from food sources has been exhausted. Because the diabetic organism, without the aid of insulin, is unable to use carbohydrate as a source of energy, it draws upon the protein and the fat for its energy. While only a little more than half of the protein is glucogenic, i.e., available as a source of carbohydrate in the normal organism, even this source of energy is unavailable in the diabetic organism due to the lack of insulin. Hence the diabetic body must make use of ketogenic fraction of fats and proteins as its chief sources of energy.

When the body is unable to oxidize the fatty acids completely, the partially oxidized products, the ketones, enter the blood stream in large quantities, thus flooding the organism and producing the condition called ketosis. The process of formation of the ketones is termed ketogenesis. The process by which ketones are prevented from being formed is called anti-ketogenesis. The ketogenic foods are proteins and fats; the antiketogenic foods are carbohydrate and a portion of the protein.

DIET THERAPY

Dietary Prescriptions

The dietary prescription takes into consideration (1) the severity of the disease and (2) the maintenance requirements.

The severity of the disease has already been discussed in connection with the tolerance and other tests. Mild cases without ketosis may be controlled by diet alone, while the more severe cases require insulin treatment as well.

The maintenance requirements are the same as for normal individuals of the same age, sex, height, weight and activity. Many normal people, however, consume a larger quantity of food than is actually required for the maintenance of health and bodily activity. The diabetic is cautioned not to exceed the actual requirements. Indeed, it is usually thought best for him to maintain himself at slightly below the average weight (see Table 12, Part Four). The energy requirements have been discussed in Chapter 6 and the protein requirements in Chapter 5. It will be remembered that for an adult the daily requirement is from 60 to 70 Gm. of protein, and the energy requirement for a man of average size doing sedentary work is from 2,000 to 2,500 calories, while a woman will require from 1,800 to 2,100 calories. The usual prescription for diabetics calls for 30 calories per kilogram (2.2 lbs.) of normal body weight.

The requirements for energy and protein are quite definitely established, but there is some difference of opinion among physicians as to the optimum ratio of carbohydrate to fat in the diet. Two grams of carbohydrate to one of protein and one of fat are frequently prescribed, thus allowing 130 to 200 Gm. to half that number of grams of fat and also of protein. In the preinsulin days the amount of carbohydrate given was necessarily much lower than it is today, and what was then described as a high carbohydrate ratio would be called low carbohydrate today. Allen, whose regimen was characterized by "starvation periods," reduced both carbohydrate and fat below what would now be considered minimum. Newburgh and Marsh used a so-called high fat diet which might just as well have been designated "low carbohydrate and low protein." In his routine diets the carbohydrate ranged from 15 to 40 Gm., while the fat varied from 90 to 210 Gm. In this diet the ratio of fatty acids to glucose was 2.0 to 2.5.

At the present time one school of thought advocates what some physi cians call a "high carbohydrate" and others a "normal carbohydrate" diet, depending upon the point of view. Compared with the usual practice in handling diabetic cases, it is high carbohydrate, but when compared with the diets of normal people it at least approaches normal carbohydrate.

Joslin [2] probably expresses the consensus of opinion at the present time in the following statement:

"The proportion of carbohydrate, protein and fat is an individual study and differs from the normal diet in that the carbohydrate content is usually lower with a corresponding increase in fat to supply the caloric allowance."

The distribution of the carbohydrate in the day's diet is quite as important as the total quantity consumed. Since the blood sugar is usually at its height during the morning hours, some advise a lower carbohydrate at breakfast, about 1/5 of the day's allowance, with 2/5 at noon and 2/5 at night. For some patients who do not require insulin treatment, the total carbohydrate is divided equally over the 3 meals. If the patient is taking regular or modified insulin the distribution will be determined by the allotment of the insulin dosage. Some physicians prefer to administer the insulin morning and night with 3/5 of the total in the morning and 2/5 at night, in which case the carbohydrate is distributed as follows: Breakfast, 2/5; dinner, 1/5; supper, 2/5. Other doctors, when using the globin insulin recommend for their more severe cases 4 meals a day, including a midafternoon lunch, in which case the carbohydrate is as follows: Breakfast, 1/6; luncheon, 2/6; midafternoon lunch, 1/6; and dinner, 2/6. For the less severe cases, 3 regular meals are served with the carbohydrate distributed as follows: Breakfast, 1/6; luncheon, 3/6; and dinner 2/6.

Although there may be some differences of opinion as to the principles just outlined, there is general agreement that the following are important factors in the dietary treatment of diabetes mellitus:

1. The caloric intake should be sufficient to maintain body weight at slightly below the average.
2. Protein should be normal, 1 to 1½ Gm. per kilogram of body weight.
3. Carbohydrates are somewhat restricted.
4. Fats are used to make up the "balance" of the total calories required. The fat must never be in sufficient quantity to produce ketosis.
5. The diet must be adequate in all essential nutrients.

The restrictions of this diet are more in relation to the quantities allowed than with regard to the variety.

DIABETIC DIET

Foods Allowed:

Cereals—All cooked and ready prepared
Breads—All plain unsweetened
Fruits—All fresh
  All canned (if water-packed)
Vegetables—All fresh
  All canned
Soups—Broths and clear soups
Meats, poultry and fish—All, lean cuts
Milk—Fresh, dried or canned (unsweetened); buttermilk or skim
Eggs and cheese—All
Butter, oils and cream—all
Nuts and soybeans
Desserts—All fruits as above, custards and gelatin dishes made without sugar
Beverages—Tea, coffee, milk, cocoa

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[2] Joslin, Elliott P.: Diabetes Mellitus in Pattee's Dietetics, New York, Putnam. 1945.

- (unsweetened), fruit juice (unsweetened)
- Condiments—Salt, pepper, vinegar and spices

Foods to Be Avoided or Used Sparingly:

- Sugar—In all forms, including candy, chewing gum, honey, sirups and molasses, jellies, jams and preserves, canned fruit unless specially prepared without sugar, pastries, cakes and sweetened desserts
- Italian pastes—Macaroni, spaghetti, vermicelli, noodles, unless substituted for bread, cereal or potato
- Vegetables high in carbohydrate—Dried peas and beans; they must be calculated on the basis of both protein and carbohydrate value of the specific food.
- Soft drinks and alcoholic beverages
- Dried fruits and vegetables and those canned with sugar
- Fried foods unless the fat used is calculated
- Note—All foods of unknown composition should be avoided

PLANNING AND CALCULATING THE DIET

The diet should be planned as far as possible around the family menus, or perhaps better still, the family's meals around the patient's diet. Although the patient must be made to realize that his health and usefulness to society depend upon his strict attention to his diet, for psychologic reasons he must not be made to feel that he is different and that he does not share in the family life. His meals must be built around the essentials, as described in the basic dietary pattern (see Chap. 19).

The doctor's prescription is given in terms of the number of grams of protein, fat and carbohydrate and this necessitates the careful calculation in terms of foods allowed and the weighing of same. For example, the prescription might be as follows:

PROTEIN	FAT	CARBOHYDRATE
75 Gm.	100 Gm.	175 Gm.

By comparison with the basic dietary pattern, as was done in the low caloric diet in Chapter 20, it will be noted that additional fat (22 Gm.), carbohydrate (26 Gm.) and calories (350) will have to be added. This permits the use of more bread and fruit with slightly less meat.

Where the food quantities and the nutrients have been determined, the food groups are broken down into 4 meals as shown on next page.

Tables of food values must be consulted frequently. For the convenience of their readers, the authors have prepared the detailed tables which appear in Part Four. Tables giving classifications of fruits and vegetables according to carbohydrate values are also given (see Part Four, Tables 6 and 7).

The Bureau of Home Economics, U. S. Department of Agriculture,[3] has given what is undoubtedly the most accurate and usable classification yet evolved. They have given not only carbohydrate values but protein and fat as well (see Table 6, Part Four). Some physicians still use the classification based on the 5-per-cent interval; this, therefore, is given as well as that of Adams and Chatfield, which is based on the 3-per-cent interval.

It must always be remembered that all tables of food values are based upon average composition. Adams and Chatfield[4] state that "not only are there differences from one to another, but different lots of the same fruit or vegetable may vary markedly in carbohydrate content, depending upon such factors as variety, cultural

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[3] Chatfield, C., and G. Adams: U. S. Department of Agriculture, Circular No. 549, June, 1940.

[4] Adams, G., and C. Chatfield: J.A.D.A **10**:383, 1935.

TYPICAL DIABETIC DIET

	Gm.		Gm.
Breakfast			
Fruit, 15%	100	Grapefruit	165
Egg	50	Egg	50
Bread	30	Bread, 1 slice	30
Cream	60	Cream, 4 tablespoons	60
Butter	10	Butter, 1 pat	10
		Coffee, 1 cup	180
Lunch			
Cheese, American	30	Cheese, American	30
Vegetable, 3%	100	Tomato and lettuce salad	100
Fruit, 15%	100	Apple	100
Bread	60	Bread, 2 slices	60
Butter	15	Butter, 1½ pats	15
Milk	200	Milk	200
Dinner			
Meat	60	Roast beef	60
Potato	100	Riced potato	100
Vegetable, 3%	200	Asparagus	100
Fruit, 15%	100	Carrots	50
Bread	60	Peas	125
Butter	20	Bread, 2 slices	60
		Butter, 2 pats	20
Evening Lunch			
Milk	200	Milk	200
Soda crackers	12	Soda crackers	12

conditions or maturity. Even at best, average figures on composition may be only rough estimates of the composition of any particular sample. Since the error introduced by the use of average figures is already present, further error from classification should be kept as low as possible. . . . On these premises the Bureau of Home Economics has set up a classification with a view of reducing the errors which arise from calculating carbohydrate at group averages. A comprehensive list of fruits and vegetables has been used and the grouping has been made after a careful study of their carbohydrate distribution. Using an interval of 3 per cent, 6 groups suffice to include practically all fruits and vegetables. The group limits and averages at which carbohydrate is calculated in each group are given."

There is probably more variation in cuts of meat than in vegetables. Fat is the factor of variance. In order to prevent any gross error, only lean meats should be served unless the fat value is quite stable, as in bacon. The shrinkage of meats, owing to cooking, introduces another variable, hence in using tables of food values, care should be taken to note whether they are based upon raw or cooked weight (see Table 1, Part Four, for raw values under names of meats and for cooked values under "Meats, cooked").

Cereals in all weighed diets should be calculated upon the dry weight. If based upon cooked weight, errors may be introduced because of difference in proportion of water used and in the evaporation. It is well to prepare individual portions of cooked cereals, although care must be taken to use a double boiler or in some way prevent loss of material adhering to the container. A typical diabetic diet is shown on previous page.

INSULIN THERAPY

Insulin, as already stated, is the internal secretion of the pancreas, elaborated by the islands of Langerhans. The discovery that insulin could be isolated from the pancreas of an animal, the development and the technic of its administration and the development of commercial standards for its production together form one of the greatest contributions of the century to medical science. Insulin is sold on the basis of its unit content, the commercial unit used being the same as that originally designed in the experimental laboratory. An insulin unit is ⅓ the quantity which will cause a 2-kilogram (4.4 lb.) rabbit to reach the blood-sugar level of .045 per cent—the convulsive level—within 5 hours. In the human being it will cause one or more grams of carbohydrate to be oxidized—usually 1½-2 Gm., but this varies with the patient and his condition. Insulin is sold in different strengths varying from 20 to 80 units per cubic centimeter. The quantity required by an individual varies with his ability to burn carbohydrate. Sufficient insulin is given to make up the deficit between the patient's tolerance and his requirements for carbohydrate.

It must be remembered that exercise increases this demand but it also increases the body's ability to burn carbohydrate. Other factors, such as strong emotion, worry or overwork, may also affect the insulin requirement. These may have the effect of raising the blood sugar and thereby disturbing the patient's carbohydrate balance.

The insulin described above is now known as unmodified or regular in contrast with modified forms of it known as crystalline zinc, protamine zinc and globin insulins described below.

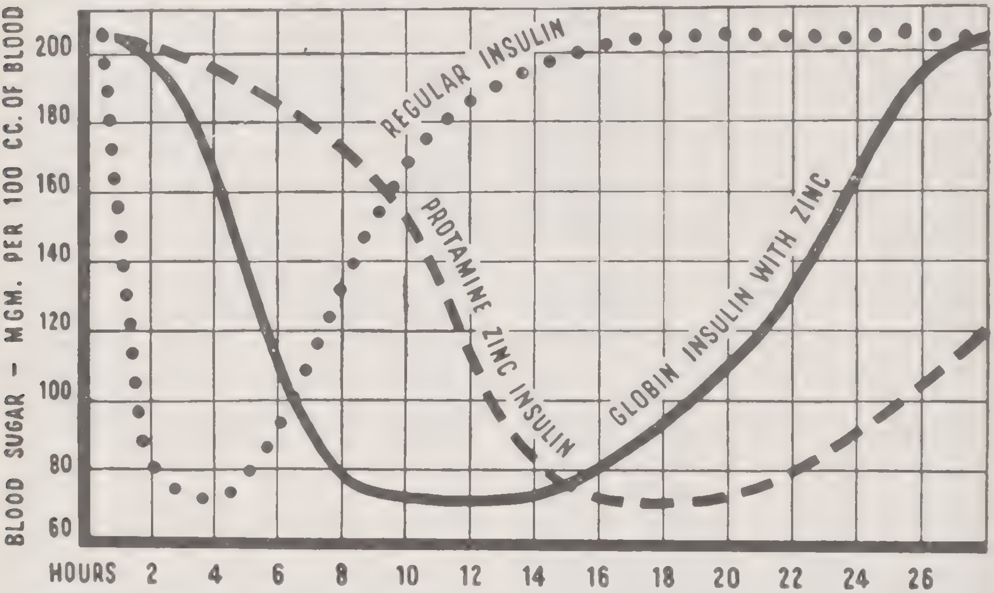
Crystalline Zinc Insulin

Research proved that insulin extracts could be crystallized and that the addition of very small amounts of zinc facilitated the process. This is a purer product than the first or regular insulin, inasmuch as it has a lower protein content. Crystalline insulin is supposed to give less allergic reactions, otherwise the action of this product is very similar to that of the regular or unmodified. Both act quickly and are effective for approximately 6 to 8 hours.

Protamine Zinc Insulin

Protamine zinc insulin was made available through the research of Hagedorn of Scandinavia and others. It was a precipitate of the regular or unmodified insulin and a protamine which originally was obtained from the sperm of a certain fish. Zinc in minute quantities was added to enhance the effect of the protamine. This type of insulin is absorbed much more slowly than the original preparation produced by Banting or the crystalline zinc insulin described above. Its effect may last for a day or more, depending upon the individual, and the drop in blood sugar is more gradual. For this reason, it is advisable to give the protamine zinc insulin 1 hour before breakfast and it is usually given only once a day. The distribution of carbohydrate intake may be different from what it is when regular or crystalline insulin is used. The breakfast should be the meal of the lowest carbohydrate value, the usual distribution being approximately as follows: Breakfast, ⅕; luncheon, ⅖; and dinner, ⅖.

Because it is slow of absorption, the single morning dose may not be sufficient to control the early morning glycosuria of a severe diabetic. This, however, may be overcome by the combined use of the regular and the protamine zinc insulins. By its use, the number of injections have been reduced from as many as 4 per day to 1 or 2, and in many cases fewer units are required. Ketosis is almost completely overcome by its use.



The above diagram shows the effects of comparable doses of various insulins on the blood sugar level of a fasting diabetic patient. Note the intermediate type of action of globin insulin as compared with regular insulin and protamine zinc insulin. (Burroughs Wellcome & Co., Inc.)

Globin Insulin

As the name would indicate, globin insulin is a combination of an aqueous solution of insulin with the addition of the protein globin derived from hemoglobin of beef blood. This product also contains zinc chloride and is a clear solution. Its action is intermediate between the regular and the protamine insulins. Its effect is apparent after about 2 hours and reaches its maximum in about 8 hours, when it begins to wane, gradually decreasing for another 8 hours. Its effect is, therefore, continuous for approximately 24 hours. When given before breakfast, the peak of its activity is reached about midafternoon. For this reason, some of the more severe diabetics find it necessary to have a midafternoon feeding.

Insulin Administration

The total quantity of insulin given may vary from 5 to 80 units. This is given in from 1 to 4 doses daily, depending upon the needs of the case and the type of insulin used. It is usually given a half hour before meals. It is very important that the dosage be properly adjusted to each day's needs, otherwise one of two serious complications may arise—ketosis if too little is given or insulin shock if too much is administered.

Unfortunately, neither regular nor modified insulin can be given by mouth; both must be administered hypodermically. It usually falls to the lot of the nurse to give insulin or to teach the patient how to administer it to himself, and it is therefore important that the nurse should acquaint herself thoroughly with the methods for doing this. For convenience, directions are given in Part Four. Other procedures concerned with the disease are also given. The student is also referred to diabetic manuals. (See list of references on diabetes, Part Four.)

DIABETIC EMERGENCIES

Coma

Coma is usually caused by overeating, by failure to take the insulin prescribed, or by fever and infection. If the carbohydrate eaten is greatly in excess of what the body can oxidize or if the body has exhausted its store of glycogen so that body fats are drawn upon but only partially oxidized, a condition already described as ketosis follows and may result in diabetic coma. This condition is usually slow in its onset and is characterized by nausea, vomiting, pain in the abdomen, thirst, deep breathing, a pungent odor of the breath, restlessness and, finally, unconsciousness. The treatment consists of rest in bed, keeping the patient warm, administering liquids (tea, coffee, hot water or broths) and insulin, with some source of carbohydrate, such as orange juice, and any other such procedures as the physician may prescribe.

The principles of treatment are (1) to ensure the burning of carbohydrate by the use of insulin, (2) to replace water and salts lost to the body because of dehydration and vomiting and (3) to give such general care as to secure the patient's survival until such time as (1) and (2) become effective.

Insulin Reactions

If too much insulin is given or too little food is taken after its administration, the blood sugar is decreased and the patient suffers a reaction or shock, characterized by a sudden onset, hunger, weakness, pallor, sweating, trembling and double vision. The patient may become hysterical, drowsy and then unconscious. It is important that this condition be treated quickly. Carbohydrate must be administered at once. Orange juice or sugar gives quick relief. Patients taking insulin are advised to carry two lumps of sugar or hard candy for just such emergencies.

The treatment for reactions from the modified insulin differs from the treatment for reactions from the regular insulin in that the carbohydrate must be given over a longer period of time. Orange juice or some other carbohydrate that is quickly absorbed should be given immediately but followed shortly by a form that is more slowly absorbed, such as milk and crackers or toast. It may be necessary to repeat the administration of carbohydrate that is rapidly absorbed for a period of several hours.

Surgery

Diabetics can now be operated upon with a comparative degree of safety.

In emergencies, as in acute, operable infections, there need be no delay in operating. In these cases, the patient is given insulin, also dextrose and physiologic saline solution intravenously. When there is time to prepare the patient, the preoperative treatment should consist of making the patient free from ketosis and his urine free of sugar, and seeing that his glycogen, fluid and salt reserves are adequate. A weighed diet accompanied by the use of insulin is of course indicated in such cases.

The diet for these patients is made somewhat richer in carbohydrate to provide extra glucose for storage as glycogen. If dehydration is apparent, fluids are given by rectum or intravenously. On the morning of operation both breakfast and insulin are withheld. Occasionally a small dose of insulin is injected before the patient goes to the operating room.

After the operation, fluids, preferably saline, should be injected. Insulin should be given in accordance with the findings of the blood-sugar determinations and the urine examinations. Since anesthesia, surgery and infection alter the insulin action, injections are usually made at intervals of less than 6 hours. Oral feeding is started as early as possible, usually after 24 hours. At first fruit juices alone are given, or ginger ale or 10-per-cent solutions of glucose. Later a more liberal diet is gradually resumed.

DIABETES IN CHILDREN

Although in general the child diabetic is given the same treatment as the adult, there are some differences which should be noted. The diet for the child must not only meet his needs when first seen, but it must also allow for periodic readjustment as he grows and develops.

The child requires more insulin and more food as he grows and develops. White [5] says that among her patients the dosage of insulin doubles from infancy to 15 years of age, practically regardless of the duration of the disease. Topper [6] has shown that diabetic children between the ages of 15 and 17 years may have a basal metabolic rate of plus 21 per cent. Joslin and White observed a 24-per-cent increase in subjects between 16 and 18 years. This increase in the basal metabolic rate, due to puberty, is normal; but in nondiabetic children it occurs earlier, between the ages of 11 and 14 years. In planning diets for diabetic children in the age range of 15 to 18 years, ample caloric allowance should be made to cover their needs.

Children, diabetic or nondiabetic, require a larger proportion of protein in the diet than adults. The younger the child the greater the proportion of protein needed. A chart by White [5] appears below, showing the dietary requirements of children of different ages.

Excitability and irritability are factors which play a greater role in the treatment of the diabetic child than in that of the adult. Above all, it should be remembered that great tact, sym-

			Average diet in grams			
Age Years	Cals./Kg.	P./Kg.	Carb.	Prot.	Fat	Cals.
5	75	3.0	140	60	70	1,400
10	65	2.5	160	70	80	1,600
15	45	1.5	180	85	90	1,900

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[5] White, Priscilla: Bull. New York Acad. Med. **10**:347, 1934.

[6] Topper, Anne: Am. J. Dis. Child. **42**:760, 1931.

pathy and understanding are necessary in dealing with such children.

DIABETES AND PREGNANCY

Since the introduction of insulin, the hazards of pregnancy in the diabetic woman have been greatly reduced. It is, of course, necessary for her to adhere very strictly to her diet, which, however, must be adjusted from time to time to meet the growth demands of the fetus (see Chap. 15) and to prevent depletion of the ma-

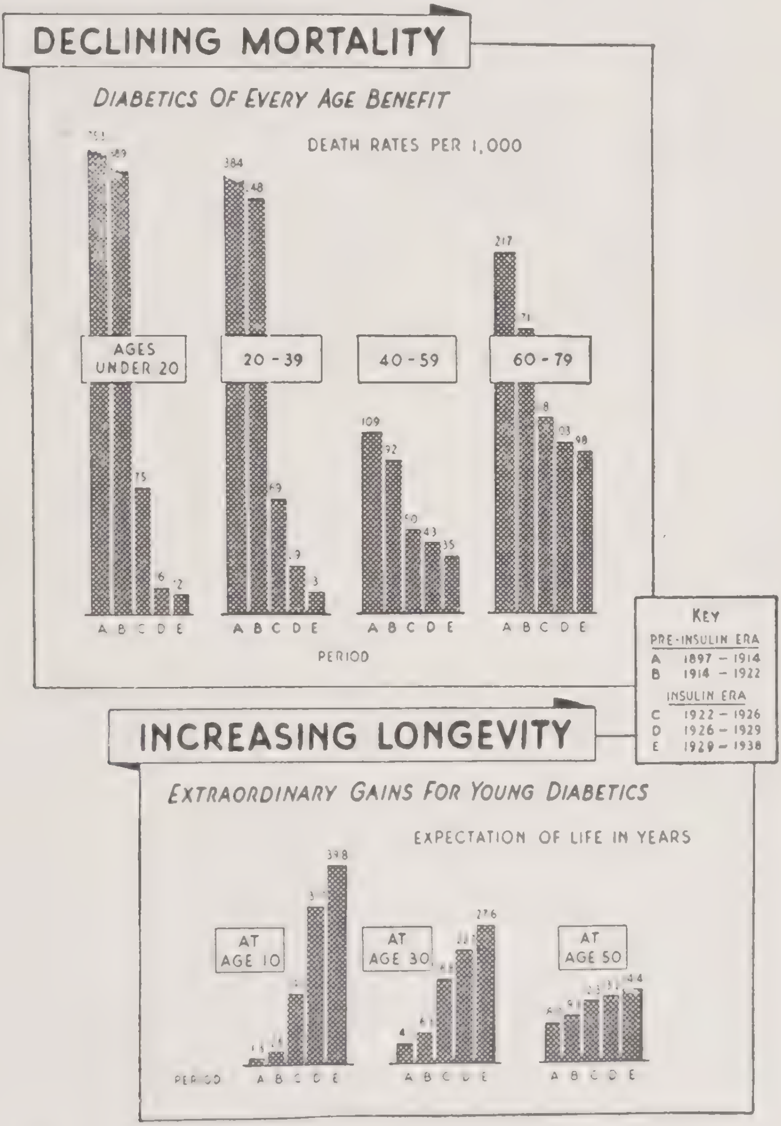

Fig. 67. Prognosis in diabetes; a summary of 40 years of progress. (Joslin, E. P.: Diabetes in the 1940's, George F. Baker Clinic, Boston, and Metropolitan Life Insurance Company, New York.)

ternal stores. Recently White and Hunt[7] have been able to reduce to a great degree the occurrence of fetal death and toxemia of pregnancy of diabetic mothers by the use of female sex hormones in those patients in whom the hormone balance has been found to be distinctly abnormal.

TEACHING THE PATIENT

The education of a diabetic patient is quite as important as the therapeutic treatment given. Everything possible should be done to interest him in his disease and to teach him at his own level of intelligence. The following procedure is advised:

The patient should be informed gradually of the principles involved in his disease and encouraged to make the necessary adjustments.

He should be warned against overeating.

He should be urged to keep his body weight slightly below the average for height, age and sex.

He should be taught to evaluate his diet.

Eventually, as his condition improves, he should be taught what substitutions he can make for foods listed on his diet.

He should learn to test his urine for sugar, using the Benedict Test. (Definite instructions may be found in Part Four or in any of the diabetic manuals mentioned in list of references under diabetes.)

Upon advice of the physician he must be taught to administer his own insulin. (See directions in Part Four.)

He should be warned of the danger of coma and insulin reaction, of the symptoms and the treatment for each.

He must be taught that he must live a simple life, avoid undue excitement, worry and strain; that rest, sleep and exercise are important; that he must eat leisurely, regularly, and on time.

Prognosis. It must be remembered that a diabetic patient is never "cured" in the sense of no longer having to consider his diet. Insulin, wonderful as it is, does not cure—it merely aids; but it nevertheless enables the patient to live comfortably and to engage in life's activities. That the life expectancy of the diabetic has been greatly lengthened by the use of insulin is shown by the preceding graphic Summary of Progress of Forty Years at the George F. Baker Clinic, Boston. (Fig. 67.)

REVIEW QUESTIONS

1. What are the causes of diabetes?
2. What symptoms does a patient with diabetes have? Why does he show each one of these symptoms?
3. What tests are performed to diagnose diabetes?
4. A patient has a fasting blood sugar of 300 mg. per cent and shows sugar and acetone in his urine. What has happened to his metabolism to bring about these two conditions? What will the treatment possibly be?
5. Which foods are glucogenic and which ketogenic in the diet?
6. A diabetic patient weighs 120 pounds. His ideal weight is 125 pounds. How many calories should he have per day? How much protein?
7. The carbohydrate allowance for a diabetic patient is 150 grams. He is being given protamine zinc insulin. How will the carbohydrate of his diet probably be divided for the day?
8. Plan a diabetic diet with the fol-

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[7] White, Priscilla, and Hazel Hunt: J.A.M.A. **115**:2039, 1940.

lowing diet order: Protein 75, fat 110, carbohydrate 200, carbohydrate divided for globin insulin. The patient is a man with a large appetite.

9. What is meant by a 15-per-cent fruit?

10. What kinds of foods should the diabetic patient avoid?

11. What kinds of foods can the diabetic patient use?

12. What substitutions can a diabetic make for a slice of bread?

13. What foods should be included in the diabetic diet to make it nutritionally adequate?

14. What is insulin? How many kinds of insulin are there? How do they differ?

15. What are the causes of insulin reactions? How are they treated?

16. How are diabetics prepared to undergo surgery?

17. What differences are there between the treatment of diabetic children and diabetic adults?

18. What precautions should be taken by a diabetic patient who is pregnant?

19. A diabetic patient is to be discharged. What should he have been taught by the time he is ready to go home?

24

Gastric Disorders

Chapter Topics

- GENERAL DISCUSSION
  - RELATION TO OTHER DISEASES
- DIAGNOSTIC TESTS
  - GASTRIC TEST MEALS
  - HISTAMINE TEST
  - RADIOGRAPHY
- FUNCTIONAL DISORDERS OF THE STOMACH
  - INDIGESTION OR DYSPEPSIA
- FUNCTIONAL DISORDERS OF THE STOMACH (CONT.)
  - HYPERCHLORHYDRIA
  - HYPOCHLORHYDRIA, ACHLORHYDRIA AND ACHYLIA GASTRICA
- ORGANIC DISEASES
  - ACUTE AND CHRONIC GASTRITIS
  - CANCER OF THE STOMACH

GENERAL DISCUSSION

Gastric diseases are usually classified as organic and functional. Organic diseases are those in which a definite pathologic change has occurred in the structural tissues, as in ulcer and in cancer. Functional disorders are disturbances of the nerve control of digestion, whether sensory, motor or secretory in nature. The stomach, it will be remembered, receives the masticated food, churns and mixes it with the gastric juice and then expels it through the pylorus. In order to perform these functions, wavelike movements, known as peristalsis, pass regularly at intervals of about 22 seconds from the cardiac end of the stomach to the pylorus. In due time the pyloric sphincter allows the chyme to pass into the intestinal tract. All this constitutes a complicated process which is under the control of the nervous system. Disturbances are usually motor or secretory, or both. The motility or the ability of the stomach to pass food into the intestinal tract may be accelerated or delayed; the gastric juice may be secreted in excessive or insufficient amounts.

RELATION TO OTHER DISEASES

Although classed as functional disturbances, many of the gastric disorders may be due to pathologic conditions in other organs. It has been well said that the stomach is a mirror reflecting the ailments of the whole abdominal region and other parts of the body as well. Chronic appendicitis, gallbladder diseases, nephritis and even pulmonary tuberculosis are known to be causes of gastric disorders. Likewise many of the neuroses, as well as the psychoses, give rise to similar symptoms. It is, of course, very important that the clinician should determine as soon as possible the fundamental causes of gastric disturbances

To this end a number of tests have been devised.

DIAGNOSTIC TESTS

Gastric Test Meals

These tests consist of chemical examinations of the contents of the stomach during the process of digestion. One or more foods and liquid, both in definite amounts, are given, usually on a fasting stomach. After a predetermined time, allowed for digestion, the contents are removed by a tube and later examined.

Ewald-Boas Test Breakfast. This test, administered in the morning before the patient has received any other food, is one of the best known of these tests. The stomach is first evacuated and the contents examined for hypersecretion, food stasis and other abnormal conditions. The meal consists of:

1 roll or 2 slices of white bread or 2 slices of toast or 4 soda crackers
2 glasses of water or weak tea

After 45 minutes to an hour, the meal is extracted. The material is examined as to gross appearance and admixtures, such as blood and bile, and also as to total quantity. An analysis is made of both the free hydrochloric acid and the total acidity. From the above examination the following interpretations may be made:

Total Quantity—Less than 20 cc. indicate accelerated evacuation
  Over 100 cc. may indicate stasis
Hydrochloric Acid—Above normal (p. 29) indicates hyperchlorhydria
  Below normal indicates hypochlorhydria
  Absence of acid indicates achlorhydria
Ferments or Enzymes—Tests are also made for pepsin and rennin, especially when acid is absent

The fractional method, advocated by Rehfuss and his associates, has been recommended as giving more accurate results than a single aspiration or withdrawal. By this method the gastric contents are withdrawn at frequent intervals following the meal and chemical analyses made of each specimen.

Histamine Test

Histamine, a drug, is the most powerful stimulus known for the secretion of gastric juice. It is, therefore, used to determine the ability of the stomach to secrete the necessary acid and pepsin, especially if the test meal shows evidence of achlorhydria. It is given subcutaneously after a 12-hour fast and after the contents of the stomach have been removed by tube.

Samples of gastric juice are aspirated at 15-minute intervals during the period of active secretion, and are then titrated for total and free acidity. The results are compared with normal figures. If much above normal and if the period of secretion is prolonged, ulcer may be suspected; if below normal, achlorhydria may be indicated.

Radiography

Radiography of the stomach is now a most important diagnostic procedure. This is an x-ray examination, and it is known also as fluoroscopy. By this means, one may follow the progress of an opaque "meal" of barium sulfate through the entire digestive tract, and can study very minutely the motility, including peristalsis, the emptying time, the general tonus, including cardiospasm or pylorospasm, defects of outline indicative of ulcer or carcinoma, and other signs of abnormalities. The barium meal is given in the morning or at least 12 hours after the taking of food or drink.

FUNCTIONAL DISORDERS OF THE STOMACH

Discomfort following meals is so common that it is usually disregarded unless accompanied by actual pain, nausea or vomiting. Since disturbed digestion may lead to chronic conditions, it is important to determine the cause, especially if the attacks recur.

Indigestion or Dyspepsia

The chief causes of disturbed digestion are:

Improper selection of food
Overeating and undereating
Rapid eating
Insufficient mastication
Improper food preparation
Fatigue
Mental strain
Emotional upsets
Lack of exercise
Idiosyncrasies about certain foods

Excessive fat may inhibit the secretion of the gastric juice and, therefore, delay digestion unduly, permitting unfavorable bacteriologic changes to take place meantime. Fried foods, heavy salad dressings, rich pastries, butter, cheeses, nuts and certain fatty fishes are frequent offenders.

Concentrated sweets may irritate the alimentary tract. Candy which is taken between meals or upon an empty stomach, cake with heavy icing and puddings rich with sweets and fats are conducive to digestive disturbances.

Meats may cause trouble, especially if the fiber is tough. Pavlov and others have shown that meat may increase the gastric acidity and therefore under certain abnormal conditions may cause pylorospasm with delayed emptying. It is known that the extractives of meat are strong stimuli of gastric secretion.

Certain fruits and vegetables are difficult to digest, either because of coarse cellulose or because of certain volatile oils.

Acids and spices also may cause discomfort by increasing the acidity of the gastric contents.

Certain foods have been labeled by experience as difficult to digest, although the reason is not always clear. Foods which often cause gastric discomfort are lobster, crabs, sardines, peanuts, some other nuts, cabbage (if overcooked), corn, cucumbers, raw apples, onions, garlic and pickles. The excessive use of strong alcoholic beverages is also a common cause of acute indigestion and if indulged in frequently may lead to acute and chronic gastritis.

Improper Eating. Too much food taken at any one meal or too much for the entire day is a tax upon the digestive functions. Also, an inadequate diet, often self-imposed by the elimination of one food after another because of some imagined or reputed ill effect, is equally bad. Rapid eating, without sufficient mastication, interferes with salivary digestion. Improper food preparation may affect digestion adversely. Undercooking, especially of starchy foods and of some meats such as veal and pork; overcooking, particularly of vegetables, and the frying of foods at too low a temperature, with the result that the fat penetrates the food, are all to be avoided. By-products of overheated fats are also irritating.

Predisposing Factors. Fatigue, worry, mental strain and emotional stress have a marked effect upon the digestive functions. In such circumstances the diet should be light and the meals simple. Lack of exercise often affects the digestive powers. The sedentary person can seldom digest properly the same amount and kind of food that can be assimilated by the active person. Lack of B vitamins may decrease muscle tone and thus affect motility.

Idiosyncrasies as to certain foods are discussed in Chapter 28.

Hyperchlorhydria

Hyperchlorhydria, or hyperacidity, while not a disease entity, is a condition characterized by excess acidity of the gastric contents and by epigastric distress. Acid readily unites with the protein of the food when present, thus forming the "acid protein," the first product of protein digestion. Any excess of acid over that which is combined with the protein is known as free hydrochloric acid; the acid which is in combination, together with the free acid, makes up the total acidity. An excess of free hydrochloric acid is irritating to the mucous lining of the stomach and may cause discomfort. Some stomachs are much more sensitive to the acid than others. Since the normal degree of acidity varies materially with the individual and with age, it is difficult to express numerically what is an excess. This is best determined by frequent testing of the individual.

Physicians differ as to the cause of this condition. Some are strongly of the opinion that it is due to a disturbance of the motor function rather than of the secretory function, believing that the retarded emptying of the stomach permits a longer secretory response and less regurgitation of alkaline juices from the duodenum. Whatever the cause, it is known that the character of the food intake will remedy or at least ameliorate the condition, making the patient more comfortable.

DIETARY TREATMENT

Fats, especially cream and sweet butter, are usually well tolerated, although fried foods are not. Protein foods, especially milk, eggs, the mild soft cheeses and tender lean meats, are easily digested. Concentrated sweets, including jellies, jams and confections, are to be avoided, also strong acids—vinegar, pickles and sometimes the more acid fruits and fruit juices. Alcoholic beverages are very distressing. Spices and condiments should be omitted from the diet.

As seen from the foregoing, the diet should be bland, i.e., should contain little or no flavorings, condiments, acids or alcohol, but should consist chiefly of simple well-cooked food in easily digested form. Orange juice and other juices, containing acid, are best tolerated by taking a few sips at a time and after some bland foods have entered the stomach. Some physicians restrict still further to vegetables and fruits of low residue and to tender meats (of low connective tissue).

Bland Diet

The following outline summarizes the important points in the treatment of many gastric disorders besides hyperchlorhydria:

Characteristics:

1. Low or soft residue and connective tissue
2. Little or no condiments, except salt in small amounts
3. Low in acid content
4. Foods simply prepared

Foods Allowed:

- Cereals—All well cooked
  - All ready cooked except bran preparations
- Italian pastes—Spaghetti, macaroni, vermicelli, noodles
- Breads—White bread (toasted or plain), rolls or crackers made of white or finely milled flour
- Fruits—Stewed prunes (except skins), canned peaches, pears, plums, apricots, white cherries, baked apple (except skin), applesauce, very ripe bananas, avocados, orange juice
- Soups—With milk or cream sauce foundation
- Eggs—Boiled, poached or scrambled in double boiler
- Meat or poultry—Broiled steak, lamb or veal chops, roast beef and lamb, chicken (broiled, boiled or roasted), fresh tongue, liver including chicken livers (plain), sweetbreads (plain)
- Fish—Baked, broiled, boiled; oysters
- Dairy products—Milk, cream, butter; cream, cottage, or other soft mild cheeses
- Vegetables—Potatoes, peas, squash, asparagus tips (well cooked or mashed), carrots, beets, string beans, spinach. (In severe cases these vegetables are puréed)
- Desserts—Gelatin desserts, tapioca, rice, bread or cornstarch pudding, custard, junket, ice cream, sponge cake, plain cookies, prune, apricot or peach whip
- Beverages—Milk, buttermilk, cocoa, malted milk, fruit juices, tomato juice, orange juice and coffee or tea (if allowed)

To Be Avoided:

- All fried or fatty foods and all highly spiced or seasoned foods
- All mustard, pepper, vinegar, ketchup, horseradish, relishes, gravies
- All smoked and preserved meat and fish
- All pork
- All raw fruits and vegetables except those listed above
- All stimulants and carbonated waters (unless prescribed)
- All pastries, preserves and candies

TYPICAL MENU

BREAKFAST

Banana, ripe
Farina with milk
Egg (1)
White bread
Butter
Coffee or substitute
Cream

DINNER

Roast lamb
Mashed potatoes
Peas
White bread
Butter
Canned pears
Tea or milk
Cream
½ glass tomato juice

SUPPER

Cream of tomato soup
Scrambled eggs
Fresh spinach
White bread
Butter
Crumb cake
Coffee or substitute
Cream
½ glass orange juice

For the treatment of heartburn, a frequent symptom of gastric disturbances, a dry diet with limitation of breadstuffs is often beneficial. No beverages are served with meals.

Hypochlorhydria, Achlorhydria and Achylia Gastrica

The conditions known as hypochlorhydria, achlorhydria and achylia gastrica represent varying degrees of diminished secretion of digestive factors in the stomach. As the name would indicate, in hypochlorhydria the acid is below normal, but some free hydrochloric acid is present; in achlorhydria no free hydrochloric acid is found but some combined acid is present; in achylia gastrica both acid and digestive enzymes are lacking. The terms achlorhydria and achylia gastrica are, however, often used interchangeably. Achylia gastrica is a characteristic symptom of pernicious anemia and is discussed in the chapter on anemias.

As in the case of hyperchlorhydria, physicians differ as to the importance to be attached to the amount of acid secreted by the stomach, as it has been found that when the stomach fails to digest because of lack or excess of acid, the duodenum usually takes over and completes the digestion. Some are inclined to believe that these conditions are not incompatible with good health, while others believe them to be associated with other disturbances, such as pernicious anemia.

Nevertheless, while the causes are being investigated, the comfort of the patient must be considered, which means of course that the diet must be adjusted to meet his needs.

DIETARY TREATMENT

The bland diet with some modifications is indicated in all cases of diminished gastric secretion. Milk used for such cases should be as carefully selected as it is for infants. The cultured-milk preparations are especially indicated. Tough skins of fruits and vegetables should be removed, and if seeds or coarse fiber exist, the vegetable or the fruit should be put through a sieve to remove them. Tomato juice and orange juice should be used as sources of ascorbic acid. Meats should be limited to the lean portions, and in severe cases should be scraped. Broths and clear soups are permitted as they stimulate gastric secretion. Fruits and fruit juices and vegetables, except those of a coarse fiber or strong flavor, are valuable. Simple desserts are indicated. Iced drinks and cold foods should be avoided.

Fats are known to inhibit the secretion of hydrochloric acid and also retard the emptying time of the stomach; hence their use should be limited to small amounts. Emulsified fats are to be preferred. Fresh butter and cream are the most easily digested fats, but in severe cases not more than an ounce of butter a day should be used. No fried foods, rich pastry or heavy puddings should be served.

Hydrochloric acid is usually prescribed to make up, in part, the deficiency in the gastric secretion.

ORGANIC DISEASES

Acute and Chronic Gastritis

Acute Gastritis. There is some difference of opinion as to whether acute gastritis is a functional or an organic disease. Gastritis is essentially an inflammation of the gastric mucosa. Acute gastritis regularly follows the ingestion of toxic substances, such as alkalis, strong acids, alcohol and certain drugs. In sensitive individuals, certain foods produce congestion which amounts to actual inflammation.

The treatment should include elimination of the offending substance as soon as possible. This is accomplished by induced vomiting or by lavage, and is followed by fasting for an appropriate interval. During this time, water should be given by enemata rather than by mouth, although bits of ice may be held in the mouth to quench severe thirst. If the ice does not induce vomiting, small amounts may be swallowed.

A liquid diet should be given the first and possibly the second day following the fast. A start should be made by giving one teaspoonful of a bland liquid such as peptonized milk, or buttermilk, or a strained gruel, and repeating in half an hour if no ill effects result from the first feeding. Both the amount and the interval should be increased until 3 to 6 ounces are given at 2-hour intervals. Solid foods should be added to the diet very gradually, crisp dry toast or crackers being the first addition to the liquid food. Toasted cereal flakes, well-cooked cereals, such as rice or cream of wheat, preferably cooked with milk, and a soft-cooked egg may be given on the third and the fourth days of feeding. A light diet (see Chap. 19) should be used when the patient's condition permits. This may be on the third, the fourth or the fifth day, but it is wise to go slowly and so reduce the chances of a relapse. Usually these illnesses last only a few days.

Chronic Gastritis. Chronic gastritis may accompany organic gastric lesions such as ulcer and cancer, or may be secondary to some other disease, such as myocardial insufficiency and nephritis, but the etiologic factors are usually the same as for acute gastritis.

THE TREATMENT, therefore, consists in first discovering the cause and treating the case accordingly. If the contributing cause is improper eating or drinking, the patient must be convinced that recovery depends upon the avoidance of the specific factor causing the irritation. The food must be easily digested, and be simply and appetizingly prepared. A bland or convalescent ulcer diet (see Chap. 25) will usually meet the needs.

However, in many cases of chronic gastritis, fluids should be limited and a dry diet given.

CANCER OF THE STOMACH

Delayed Diagnosis. Because the onset is usually very gradual and there are no distressing symptoms in the early stages of cancer of the stomach, it is frequently overlooked until too late to effect a cure. For this reason, any continued abdominal discomfort in a middle-aged or elderly person should be investigated, even though seemingly inconsequential. This is another reason why middle-aged people should undergo a periodic physical examination.

Diagnosis. X-ray tests have been perfected whereby it is easier to diagnose this condition in its incipiency when surgical intervention is more likely to be successful. Lack of appetite over a long period of time and newly acquired constipation with loss of weight and strength are symptoms suggestive of carcinoma. Distaste for meat and fish is often striking. The absence of free hydrochloric acid in the gastric contents is suggestive, although in the earlier stages it may even be increased. Occult blood is frequently present in the stools. The most important method in diagnosing cancer, however, is by x-ray.

Dietary Adaptations. While diet is not in any sense curative in this condition, certain modifications of the bland diet may add greatly to the comfort and the well-being of the patient. The diet must always be adapted to the general condition of the patient. When the gastric secretion is depressed or lacking, the diet as outlined for hypochlorhydria is indicated; it there is increased secretion, then that outlined for hyperchlorhydria or convalescent ulcer will be helpful. Often a liquid diet is more suitable to the patient's needs.

In the later stages of the disease, it is often necessary to resort to parenteral fluids or transfusions.

When an operation has been performed, the diet should follow that outlined in the chapter on preoperative and postoperative diets.

REVIEW QUESTIONS

1. What is the procedure for making a gastric analysis? What observations are made in such a test?
2. A patient complains that he is troubled with indigestion. What are the possible causes of his dyspepsia? What information is needed for diagnosis? What would you advise him to do about it?
3. What is meant by hyperchlorhydria? How does this differ from acidosis?
4. A patient is discharged on a bland diet. He has asked that you tell his wife what he should eat at home. Outline the instructions you would give her.
5. How is acute gastritis treated? Chronic gastritis?
6. What dietary measures can be used for people who have cancer of the stomach?
7. Show how a bland diet can meet all the requirements for adequate nutrition.

25

Peptic Ulcer

Chapter Topics

- GENERAL DISCUSSION
- CAUSES OF PEPTIC ULCER
- SYMPTOMS
- TREATMENT
  - MEDICAL AND SURGICAL
- TREATMENT (CONT.)
  - DIETARY
    - THE SIPPY DIET
    - CONVALESCENT ULCER DIET
  - BLEEDING ULCERS

GENERAL DISCUSSION

Peptic ulcer is a term used to designate an eroded lesion which occurs in either the stomach or the duodenum. Lesions usually occur along the lesser curvature of the stomach, in the pyloric end of the stomach or in the duodenum near the pylorus.

Duodenal ulcers are much more common than gastric ulcers. Whether in the stomach or in the duodenum, they need similar treatment and are therefore considered together in this chapter. They are always troublesome and often endanger the life of the patient, as hemorrhage and perforation are likely to occur. Cancer, too, may result from gastric ulcers.

CAUSES OF PEPTIC ULCER

Many theories have been advanced as to the cause of these lesions. Rivers [1] groups the probable causes as follows:

1. **Neurogenic factor.** Some believe that disturbances in the nervous system cause impoverishment of the blood supply leading to mucosal erosions.

2. **Circulatory disturbances** in the veins and the arterioles of the submucosa, resulting in necrosis, which is followed by ulceration due to the digestive action of the gastric juice.

3. **Erosion of Tissue by Acid.** Abnormally concentrated gastric juice is known to produce erosion, but why the mucosa is unable to withstand the attack of acid in some individuals is not clear.

4. **Inflammation and Infection.** Possible result of focal infection.

5. **Acid Factor.** After the initial lesion has been produced by any of the above causes, it is assumed that the most important perpetuating factor in the ulcer patient is high and continuous gastric acidity.

Wolf and Wolff [2] reported their findings of a gastric fistula of many years' duration. They found that "emotional conflict involving anxiety, hostility and resentment was accompanied by accelerated acid secretion, hypermotility, hyperemia and engorgement of the gastric mucosa, resembling 'hypertrophic gastritis.'" They therefore conclude that "the chain of events which begins with anxiety and conflict and their associated overactivity of the stomach and ends with hemorrhage or perforation is that which is involved in the natural history of peptic ulcer in human beings."

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[1] Rivers, A. B.: Am. J. Nursing **37**:711, 1937.

[2] Wolf, S., and H. G. Wolff: J.A.M.A. **120**:670, 1942.

SYMPTOMS

Hyperchlorhydria and hypersecretion of gastric juice are frequent symptoms of these ulcers, although occasionally hypoacidity is an accompaniment, in which case carcinoma may be suspected. Pain in the epigastrium which occurs more or less regularly 2 to 4 hours after meals is characteristic of peptic ulcer, especially so if it is of a burning or gnawing type and is relieved by the taking of an alkali or food.

If the ulcer is in the cardiac end of the stomach, the pain will occur very soon after the taking of food. Often a hemorrhage or a perforation is the first noticeable symptom. Occult blood in the stools is one means of diagnosis, but the more important objective symptoms are observed by means of the fluoroscope and the x-ray. In advanced cases, loss of weight and dehydration are prominent symptoms. Low serum-protein and amino-acid levels are frequently observed in ulcer patients.

Recurrences of attacks lasting for a few weeks occur more or less intermittently for years. They may be precipitated by severe emotional strain, by the excessive use of alcohol or by indiscretions of diet.

TREATMENT

Medical and Surgical

Rest, both physical and mental, is demanded in all severe cases. This may mean hospitalization or at least rest in bed for a period ranging from a few days to several weeks. Many of the ambulatory cases are advised to make a change of occupation if it entails work requiring heavy lifting or pulling.

Medication is usually limited to the giving of alkalis for the purpose of neutralizing some of the gastric acidity. This is given between feedings. Aluminum hydroxide gel or a similar antacid preparation often is prescribed for this purpose.

Experimentally an extract from the duodenal-jejunal mucosa called enterogastrone has been shown to inhibit gastric secretion and motility. This hormone has not yet been used in the treatment of gastric ulcer, though theoretically it should be of some value in reducing gastric acidity.

Many surgeons feel that operative measures are indicated in peptic ulcer, but it is generally agreed that medical treatment in the early stages is warranted, at least as a trial measure.

Dietary

Of all the medical treatments prescribed, there is no doubt that careful dieting is the most important. The characteristics of the diet are as follows:

1. Mechanically and chemically nonirritating foods
2. Foods that neutralize and inhibit acidity
3. Frequent and small feedings
4. Gradual but ultimate restoration to an adequate diet

A mechanically nonirritating diet is one that is low in residue and therefore free from substances likely to cause an abrasion or irritation when coming in contact with the eroded surface.

A chemically nonirritating diet is one that is free from condiments: pepper, mustard, spices; low in sweets (only small amounts of sugar or honey being allowed); free from strong acids (vinegar, pickles, strongly acid fruits and juices); low in coffee and caffeine-containing beverages which recent research [3] seems to indicate stimulate gastric secretion; and low in meat extractives, no broths, soups or gravies being allowed until convalescence is well established. Foods that cause a high secretory response or are irritating are thus excluded. Alcohol and tobacco are also prohibited for this reason.

Foods that lower the gastric acidity are proteins and fats. The protein combines with the free acid and thus neutralizes the acidity; the fat inhibits the secretion of the hydrochloric acid. Therefore, milk, eggs, cream, butter and olive oil are especially valuable in the treatment of peptic ulcer. A high protein diet is now quite frequently prescribed.

Frequent and small feedings are important. Some dietary plans call for small hourly feedings; others, for feedings every 2 hours, or 6 feedings per day. Food in the alimentary tract takes up the excess of acid which would otherwise excite the so-called hunger pains so characteristic of ulcer; with frequent feedings, it is of course necessary to give small quantities of food and to plan the diet carefully so as to meet all nutritive requirements.

The normal dietary requirements must be met in this disease as well as all other diseases. The initial diet is lacking in some of the essentials, but these deficiencies should not long be overlooked. Vitamins and minerals must be given careful consideration in the planning of the diets. Ascorbic acid should be prescribed if fruit rich in this factor must be omitted.

Many diets have been devised for the treatment of peptic ulcer, including those of von Leube, Lenhartz and Coleman, all of which embodied some or all of the required characteristics listed above. The von Leube plan prescribed feedings every 2 hours while that of Lenhartz included hourly feedings from 7 A.M. to 9 P.M. The Coleman diet was characterized by olive oil, which depressed the secretion of acid, and egg white, which combined with it. Glucose was also given by rectum. Einhorn devised a method of tube feeding known as transgastric, the tube remaining in place for a period of about 2 weeks, being secured by adhesive to the outer portion of the cheek. Milk, egg and lactose formed the basis of the formula originated by Einhorn.

THE SIPPY DIET [4]

This diet has largely supplanted the foregoing diets, and in turn has met with several modifications. The characteristics of Sippy's treatment are as follows:

1. Rest in bed for 3 or 4 weeks; no active work for the following 3 or 4 weeks at least.
2. Alkaline powders between feedings throughout the day.
3. At 10 P.M. the stomach is relieved of all acid and other contents by means of a stomach tube. This

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[3] Roth, J. A., A. C. Ivy and A. J. Atkinson: J.A.M.A. 124:814, 1944.

[4] J.A.M.A. 64:1625, 1915.

process may be repeated during the night.

4. Milk and cream (in equal parts) are given hourly in 3-ounce portions from 7 A.M. till 7 P.M. This is continued for 2 or 3 days.

5. To the above milk-and-cream regimen are added, gradually, soft-cooked eggs and well-cooked cereals until at the end of 10 days the patient is receiving daily not only the milk-and-cream mixture as above, but 3 soft-cooked eggs (1 at each of 3 meals) and 9 ounces of cooked cereal (3 ounces at each of 3 meals), the cereal and the egg meals alternating.

6. Cream soups, vegetable purées, custards and other soft foods may be added or substituted, never more than a total of 6 ounces in volume being allowed at any one feeding.

7. In the fourth week the milk-and-cream mixture may be increased to 5 ounces and a 2-hour feeding schedule begun. After a few more weeks, a 3-hour schedule will suffice.

8. With some few additions, such as bread, butter and meat, and a decrease in some of the alkali, this diet is continued for a year or more.

This treatment is marked by the use of alkaline powders to neutralize the excess hydrochloric acid and thus allow the eroded surface of the ulcer to heal. The diet is nonirritating and bland, sufficient in calories and in protein, and is given at frequent intervals. Patients on this diet for long periods are in danger of developing avitaminosis and alkalosis.

Modified Sippy Diet

This diet is based on the Sippy principles and modified in some respects as suggested by Kantor.[5] It provides for 2-hour feedings consisting of 3 ounces of milk or 20-per-cent cream with additions as indicated in the schedule of feedings on page 304. When milk cannot be tolerated, gruels may be substituted for the basic feeding and handled in the same way.

Additions:

1. Eggs, soft-cooked or raw.
2. Cereals, including well-cooked farina, cream of wheat, rice and strained oatmeal.
3. Puréed vegetables: spinach, corn, peas, carrots, squash, string beans and mashed or baked potatoes.
4. Cream soups, using the above cereals or puréed vegetables as a base.
5. Toast (approximately 1 ounce per slice) and plain white crackers. Butter.
6. Desserts: custard, junket, gelatin dessert, puddings of rice, cornstarch, tapioca, farina and bread.
7. Cottage cheese or cream cheese.

Note: Small amounts of sugar, salt, and cocoa may be used for flavoring.

Kantor and others are inclined to use this diet for a few days only, proceeding as rapidly as the patient's condition permits to a convalescent ulcer diet, a bland and, later, a regular diet.

CONVALESCENT ULCER DIET

Characteristics:

Mechanically and chemically nonirritating
Three small meals, with 3 supplementary feedings, at 10 A.M., 4 P.M. and 10 P.M.

Foods Allowed:

Cereals—All ready-to-eat cereals except those containing bran. Cooked cereals, such as farina, cornmeal, rice and oatmeal gruel
Italian pastes—Macaroni, spaghetti, vermicelli, noodles
Bread—Enriched white bread or rolls,

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[5] Kantor, J. L.: Synopsis of Digestive Diseases, St. Louis, Mosby, 1937.

SCHEDULE OF FEEDINGS

	Modified Sippy Diet													Convalescent Ulcer Diet 14 on	Standard Bland Diet
Day	1	2	3	4	5	6	7	8	9	10	11	12	13		
Hour	Oz.	Oz.	Oz.	Oz.	Oz.	Oz.	Oz.	Oz.	Oz.	Oz.	Oz.	Oz.	Oz.		
7 A.M.	3	3	6	6	6	9	9	9	12	12	12	15	15	Breakfast	Breakfast
9 A.M.	3	3	3	3	3	3	3	3	3	3	3	3	3		
11 A.M.	3	3	3	3	3	3	3	3	3	3	3	3	3	10 A.M. 1 glass milk	
1 P.M.	3	6	6	6	9	9	9	12	12	12	15	15	15	Dinner	Dinner
3 P.M.	3	3	3	3	3	3	3	3	3	3	3	3	3		
5 P.M.	3	3	3	3	3	3	3	3	3	3	3	3	3	4 P.M. 1 glass milk	
7 P.M.	3	3	3	6	6	6	9	9	9	12	12	12	15	Supper	Supper
9 P.M.	3	3	3	3	3	3	3	3	3	3	3	3	3		
TOTALS	24	27	30	33	36	39	42	45	48	51	54	57	60	10 P.M. 1 glass milk	

TYPICAL MENUS

1st Day—3 oz. of 20% cream every 2 hours from 7 A.M. to 9 P.M.
2d Day—Same as first day plus
1 egg at 1 P.M.
1 oz. slice toast
1 pat butter
3d Day—Same as second day plus
3 oz. cereal at 7 A.M.
4th Day—Same as third day plus
3 oz. cereal at 7 P.M.
5th Day—Same as fourth day plus
3 oz. mashed potato at 1 P.M.
6th Day—Same as fifth day plus
1 egg and 1 oz. toast with 1 pat butter at 7 A.M.
7th Day—Same as sixth day plus
3 oz. custard at 7 P.M.
8th Day—Same as seventh day plus
3 oz. pudding at 1 P.M.
9th Day—Same as eighth day plus
3 oz. apple sauce at 7 A.M.
10th Day—Same as ninth day plus
3 oz. cottage cheese at 7 P.M.
11th Day—Same as tenth day plus
3 oz. puréed vegetable at 1 P.M.
12th Day—Same as eleventh day plus
3 oz. milk toast at 7 A.M.
13th Day—Same as twelth day plus
3 oz. puréed vegetable at 7 P.M.
14th Day—Convalescent ulcer diet

toasted or plain, zwieback, soda crackers
Fruits—Citrus fruits, applesauce, baked apples without skin, ripe or baked bananas, diluted fruit juices, stewed or canned pears, peaches and peeled apricots, purée of all dried fruits except figs. It is advisable to take citrus fruit juices after eating some of the other foods of the meal.
Vegetables—Potatoes, baked (skin excluded) and mashed; asparagus tips, squash, puréed peas, beets, carrots, string beans, spinach
Eggs—All forms except fried and scrambled in fat
Meat, fish and poultry—Poultry, free of skin, chicken livers, lamb (tender) or scraped beef, sweetbreads, fresh fish
Cheese—Cream, pot, farmer, cottage and other soft mild cheeses
Butter or margarine
Desserts—Ice cream (plain), custard, simple puddings (tapioca, rice, bread or cornstarch), gelatin desserts, sponge and other plain cakes
Beverages—Cream, milk, buttermilk, eggnog, cocoa, malted milk, orange juice, tomato juice, and tea and coffee (if allowed)

To Be Avoided:
All fried, highly seasoned or spiced foods
Condiments—Mustard, vinegar, ketchup, horseradish, pickles and relishes
Meat soups and gravies
Smoked and preserved meat and fish
Pork
Raw fruit and raw vegetables except ripe bananas and orange juice
All gas-forming vegetables, including cucumbers, onions, cabbage, cauliflower, Brussels sprouts, broccoli, turnips, radishes
Alcoholic beverages and carbonated waters
Pastries, nuts, raisins, currants and candies
Breads, freshly baked

Supplementary Feedings:
10 A.M.—Glass of milk, malted milk, eggnog
4 P.M.—Glass of milk, or milk beverage
10 P.M.—Glass of milk or eggnog

TYPICAL MENU

BREAKFAST

Apple sauce
Oatmeal gruel with milk
Egg (1), soft-cooked
White toast
Butter
Coffee or substitute
Cream

DINNER

Chicken
Baked potato
String-bean purée
White bread
Butter
Canned peaches
Tea
Cream

SUPPER

Broiled fish or
Cottage cheese
Boiled potatoes
Cocoa
White bread
Butter
Gelatin dessert with whipped cream

Supplementary feedings: see above.

Bleeding Ulcers

Physicians are somewhat divided as to how best to treat a bleeding ulcer. Formerly food was withheld for 24 to 72 hours after bleeding ceased. Now many believe that food should be given during this period in order to prevent hypoproteinemia, which in turn delays the healing of the ulcer. Kantor says that if the patient has nausea or vomiting, heartburn or hiccough, it is not practical to give food within the first 24 to 48 hours. If, however, the patient has no gastric distress and is hungry, feeding may be begun at once. If early feeding is impractical, intravenous alimentation is indicated. Not only is glucose used for this purpose, but the recently developed protein hydrolysates also. Blood transfusions are often given to speed up the healing process. Andreson[6] in this country and Meulengracht in Europe were early advocates of this type of management.

Gelatin was one of the chief constituents of Andreson's diet and purées of Meulengracht's. By the latter treatment the patient is fed from the very onset of the hemorrhage what is termed a "full purée" diet, supplemented by doses of iron and alkalis, although alkalis are not considered necessary or desirable by some physicians. The purée diet may be given as follows:

6 A.M.—Tea, white bread and butter
9 A.M.—Oatmeal with milk, white bread and butter
1 P.M.—Dinner
3 P.M.—Cocoa
6 P.M.—White bread and butter, sliced meats, cheese and tea

The dinner may include such foods as soup, creamed and puréed; minced and broiled meats, including liver, and poultry; broiled, baked or creamed fish; plain cooked eggs; mashed potatoes, puréed vegetables and fruits; custard, plain ice cream and puddings—rice, cornstarch, tapioca and gelatin. White bread, crackers, butter and milk beverages are also included.

For other schedules see reference in footnote.[7]

Protein Hydrolysates in Treatment. A recent trend in the treatment for ulcer patients is the use of protein hydrolysates (200 to 300 Gm.) and dextrimaltose to make up a caloric intake of 2,800 to 3,000 calories. Quite recently Co Tui[8] has done some very interesting work with peptic-ulcer cases which would seem to require a high-protein, high-caloric diet due to chemical findings of protein deficiency. While it is generally recognized that feeding a diet of natural foods is to be preferred, it often happens that patients are unable to eat the foods offered or, if so, only a portion of what is needed. To 27 peptic-ulcer cases Co Tui gave feedings every 2 hours that consisted of protein hydrolysates, dextrimaltose and water in amounts equal to a high-protein and a high-calorie diet (2,800 to 3,000 calories). He summarizes his results as follows:

Pain and distress stopped in 24 to 48 hours; vomiting stopped 48 hours after institution of the feedings; rapid roentgenologic healing; positive nitrogen balance averaging 10 to 16 Gm. (first 10 days); gain in weight, 1 to 8 kilos in 2 to 3 weeks; and rapid gain in strength and in morale.

However, the treatment does not prevent recurrence on resumption of old dietary habits. Whatever method of treatment is used, the patient must understand that ulcers heal slowly, that they often recur, and that he should be very cautious about discontinuing the prescribed diet. It may be necessary to continue the diet, with some modifications, for months and sometimes years.

REVIEW QUESTIONS

1. What are some of the possible causes of gastric and duodenal ulcers?

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[6] Andreson, Albert F. R.: Am. J. Digest. Dis. 6:641, 1939.

[7] Schiff, Leon: J. Am. Dietet. A. 18:298, 1942.

[8] Co Tui: Bull. New York Acad. Med. Dec., 1945.

2. Of what does the patient with peptic ulcer usually complain?

3. Why is alkali given to patients with ulcers? What alkalis are preferred, and why?

4. A patient has been diagnosed as having a peptic ulcer and has been placed on a bland diet. What explanation should be given him so that he may grasp the necessity for following his diet? What specific foods should he avoid?

5. A patient on a bland diet works from 8:00 A.M. to 5:30 P.M. and must carry his lunch. What suggestions can you make to enable him to follow his diet while at work?

6. What are the principles of the Meulengracht diet?

26

Diseases of the Intestines

Chapter Topics

CONSTIPATION
  ATONIC TYPE
  SPASTIC TYPE
INTESTINAL OBSTRUCTION
HEMORRHOIDS
DIARRHEA
  TEST DIETS
SPRUE
COLITIS
  SIMPLE COLITIS
  MUCOUS COLITIS
  ULCERATIVE COLITIS (COLITIS GRAVIS)
DIVERTICULOSIS: DIVERTICULITIS
FLATULENCE

CONSTIPATION

By far the most common ailment of the digestive tract is constipation, said to be a disease of modern civilization caused by sedentary occupations, by nervous strain and worry, by overrefinement of food and by wrong dietary and hygienic habits. In reality, it is only a symptom due to a variety of causes, including those mentioned, as well as predisposing gastric disorders, particularly of a motor type. The chief cause, however, is a faulty diet. In planning a diet for this condition, the type of constipation must be known. Two kinds are generally recognized: atonic and spastic.

Atonic Type

A strictly atonic condition is not so common as was formerly supposed. Some degree of spasticity is usually present. This type of inactivity may be the result of a previous illness or chronic invalidism, an operation, pregnancy, obesity, or possibly of a specific dietary lack, particularly that of thiamine, any one of which may cause the muscular wall of the bowel to lose its tone. Irregular meals, insufficient water and unpleasant psychic factors are likely to result in constipation.

Inattention to nature's call to evacuate is most conducive to constipation, as the reflex becomes dulled and there is less desire to evacuate the next time. Irregular and infrequent hours at the stool have the same effect. Soon after meals seems to be a suitable time, as the taking of food stimulates peristalsis along the entire alimentary tract. It is generally agreed that when a normal diet is taken, there should be at least one bowel movement per day. There is no cause for alarm if occasionally no defecation takes place for more than a day, especially when this follows a day having a more copious evacuation than usual or one in which little food is taken. Indeed, in some cases a bowel movement every other day may be normal. In other words, the establishment of a regular rhythm is the most important consideration.

When chronic constipation exists, there are unpleasant symptoms, such as headache, malaise, bad breath and a coated tongue. Some physicians believe that these are caused by the absorption of toxic substances from the retained fecal mass, due to the increased permeability of the intestinal wall, probably because of the pressure against it; while others claim they are due to pressure on the nerve endings in the lower colon. When such symptoms occur, immediate relief may best be obtained by the use of an enema, but this should be given only if prescribed by the physician.

DIETARY TREATMENT

Peristalsis, the muscular movements by which food material is moved along the intestinal tract, is stimulated chiefly by pressure; therefore fiber, which absorbs liquids in its passage along the intestinal tract and thereby produces bulk, is a natural remedial agent for atonic constipation. It is found in vegetables, in fruits and in whole cereals, particularly in the outer portion of the grain.

The normal diet contains 5 to 7 Gm. of fiber, according to Cowgill[1] and others, but in constipated subjects this quantity may need to be increased. There is undoubtedly a quantitative relationship between the amount of fiber ingested and the laxative result. In cases of atonic constipation the patient should be asked to keep a record of foods eaten, after which the fiber content should be calculated. Usually it will be found to be deficient. The diet should then be planned and calculated as carefully as a diabetic's diet or other special diet. (This may be done by referring to tables[2] in Part Four. A well-balanced diet may be obtained by distributing the fiber almost equally among the fruits, the vegetables and the cereals, or approximately 2 Gm. from each of these sources. Thus, three fruits (one for each meal), such as prunes, apples and bananas, will yield this amount. Four vegetables, including one serving of potato and one each of string beans, spinach and asparagus, will yield 2 Gm. or more. Two slices of whole-wheat bread at each meal will supply the remaining 2 Gm. of fiber.

It will be noted, therefore, that special attention should be given to the fruits, the vegetables and the whole cereals in the diet. It may be found advantageous to substitute fruits for such bland desserts as ice cream, custard and gelatin preparations.

Bran may be added to cereals or to breadstuffs in the more obstinate cases of atonic constipation. Bran should be used in moderation, as intestinal block has been caused by a bran bolus, and in sensitive alimentary tracts the bran may be an undesirable irritant. As a rule, the dietary tracts of children are too sensitive to stand high roughage diets. Agar, an artificial bulk producer, is often prescribed to be taken in soups, breads, and sometimes made up into jellies, in which form it resembles gelatin. Agar and certain commercial preparations which are sold as laxatives owe their medicinal properties to the fact that they absorb and hold moisture and thus prevent undue drying of the fecal mass, which tends to make defecation difficult. Frequent drinking of water, 8 to 10 glasses per day, is usually recommended. Water taken before breakfast or before other meals is believed to stimulate peristaltic activity.

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[1] Cowgill, G. R., and W. E. Anderson: J.A.M.A. **98**:1866, 1932.

[2] *See also* Kantor, J. L., and L. F. Cooper: Ann. Int. Med. **10**:965, 1937.

Vitamins. Animal experimentation and clinical experience indicate that vitamin B_1 is of value in maintaining the general tonicity of the intestinal tract. It will be noted that many of the foods recommended above because of their bulk may really be of value chiefly for their high thiamine content. For foods rich in thiamine (B_1), see Chapter 8 and Tables 1 and 2 in Part Four.

Other Laxative Factors. Fats and oils are useful components of a laxative diet. Most of these are digested and absorbed before they reach the colon, but doubtless in many cases a sufficient quantity passes through to produce some lubrication. The nondigestible mineral oil or petrolatum is no longer recommended for this purpose, but if used at all it should be taken at night and should not be served with food (see Chap. 4). Sugars and organic acids also stimulate peristalsis, and these constituents, together with fiber, account for the laxative properties of fruits. Prunes, however, are known to contain, in addition to the fiber, a chemical substance which increases their laxative properties.

High Fiber and High Vitamin Diet for Atonic Constipation

(Also known as High Roughage, High Cellulose or High Residue Diet)

Characteristics:

1. Increased bulk
2. Increased water
3. Lubricants
4. Vitamins, especially thiamine
5. Sugars and organic acids
6. Normal protein and caloric values

Foods Allowed:

The diet consists of the general or house diet supplemented by one or more of the following:

1. Fruit, all kinds, especially figs, prunes, raisins, dates, apples, grapes
2. Fruit juices, all kinds, especially orange and prune
3. Salads, with mayonnaise or French dressing
4. Vegetables, especially those high in fiber
5. Dark bread, including whole-wheat and rye bread, bran muffins and bran bread
6. Cereals, rolled oats, whole-wheat cereals, both cooked and "ready cooked," prepared bran when combined with other cereals
7. Buttermilk
8. Jams, jellies, molasses
9. Wheat germ, yeast preparations or concentrates.

TYPICAL MENU

BREAKFAST

Orange juice
Whole-wheat cereal with milk
Whole-wheat toast
Stewed prunes
Butter
Coffee
Cream

DINNER

Vegetable soup
Roast beef
Baked potato
Carrots
Head lettuce
Whole-wheat bread
Apple, baked or raw
Coffee
Cream

SUPPER

Cream of corn soup
Omelet
Fresh spinach

Tomato salad
Rye bread
Butter
Ripe banana with cream
Tea

Exercise, correct posture and proper abdominal massage are also helpful in correcting atonic constipation. Fluids in abundance are indicated as an aid to the formation of normal stools. These are believed to be more effective if taken with the meals. These measures, together with diet, should take the place of cathartics and the indiscriminate use of enemas which have a weakening effect upon the walls of the intestine and ultimately intensify the condition which they are expected to remedy. If a laxative is taken it should be by doctor's prescription.

SPASTIC TYPE

Spastic constipation, owing to increased tonicity of some portion of the intestinal tract (see accompanying illustration), is very different from the atonic type. It is caused by overstimulation, resulting in a contraction which is usually accompanied by pain. It frequently occurs in cases of colitis or may follow some other gastro-intestinal disturbance. It may be of nervous origin—at least it often occurs in certain nervous disorders. It may be caused by irritation of a chemical or mechanical nature: condiments, alcohol, excessive use of tea, coffee or tobacco, purgatives and sometimes very coarse foods. Whatever the cause, there is more or less of an impaction of the fecal mass at the point of spasticity and the diet must be planned to prevent further impaction and to avoid further irritation. The usual symptoms are pains in the lower left quadrant of the abdomen and the passage of small thin stools or of small hard masses.

DIETARY TREATMENT

The dietary treatment of spastic constipation is usually the reverse of

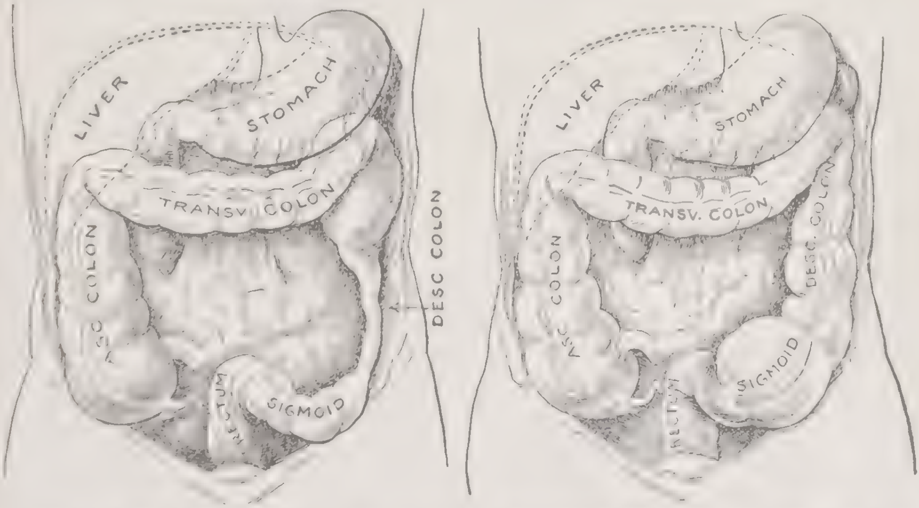

FIG. 68 (*Left*). Spastic constipation. Showing great constriction in the descending colon. Compare the colon in atonic constipation. (*Right*) Atonic constipation. Note the abnormal distention in the descending colon owing to its relaxed, atonic condition.

the treatment for constipation of the atonic type. Only the softer forms of cellulose may be given. Sometimes it is necessary to begin the treatment with foods containing little or no cellulose, such as milk, eggs, malted milk, gruels, fruit juices, especially orange juice, and gradually add vegetables, fruits and cereals that are low in residue. Purées are an especially desirable form at this time. Milk to which lactose or dextrimaltose has been added makes an excellent food, since these carbohydrates tend to reduce putrefaction and often are slightly laxative. The fats and the oils are especially indicated in this condition. These patients may need more than the average thiamine allowance, possibly in the form of concentrates, because dietary restrictions make it difficult to obtain from natural sources. In general a bland diet, as previously outlined, is indicated. After any special dietary treatment the return to a normal diet should be gradual.

INTESTINAL OBSTRUCTION

This, as the name would indicate, is a partial or complete obstruction due to a cancer or a tumor, to adhesions or to an impaction from any other cause. The condition usually requires surgical treatment; but sometimes it is inoperable and the diet must be selected with a view to keeping the patient as well nourished and as comfortable as possible. The diet should be much the same as that for spastic constipation. It should contain as little indigestible residue as possible. Gas-forming foods and foods that are conducive to putrefaction should be avoided. It should consist of easily digested foods and should contain, if possible, sufficient calories to meet the bodily requirements, as well as sufficient proteins, vitamins and minerals.

HEMORRHOIDS

Hemorrhoids are varicose veins round the anal sphincter. They may be internal or external. Some of the causes of the condition are child-bearing, constipation and the long-continued use of cathartics and enemas. The symptoms are bleeding, itching and pain. The purpose of the treatment is to restore normal function of the intestinal tract. A bland diet, rich in fat and in nonirritating forms of bulk or fiber, such as puréed vegetables and fruits, is given in addition to local treatment. Surgery is used in severe cases.

DIARRHEA

Diarrhea is the opposite of constipation. It is characterized by an abnormally rapid passage of food along the alimentary tract, thus preventing complete digestion and absorption. The total quantity and the water content of the feces are increased, and frequently there is undigested food in the stools. The stools are also increased in number.

Functional or Organic. Kantor[3] classifies diarrheas as functional and organic in character. "The organic cases are characterized by the presence, the functional by the absence, of a demonstrable lesion of the intestinal mucosa. In organic diarrheas the stools contain pus, blood, infectious bacteria or parasites; the mucosal lesions may be seen through the proctoscope; there may be anemia, fever, emaciation, dehydration or collapse.

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[3] Kantor, J. L.: Synopsis of Digestive Diseases, St. Louis, Mosby, 1937.

In the functional diarrheas these features are absent. However, two important points must be kept in mind: first, that long-continued diarrheas may lead to malnutrition, dehydration and loss of salts with resultant disturbance of the acid-base balance of the body; second, that even extensive lesions such as ulcers and tumors may be present without the occurrence of any diarrhea whatever."

All organic diseases are more serious than the functional; similarly, the organic diarrheas are more serious than the functional.

Among the causes of the functional forms are: (1) Spoiled or unsuitable food; (2) putrefaction within the intestinal tract, usually associated with achylia gastrica; (3) fermentation, associated with incomplete starch digestion; (4) delayed emptying of stomach; (5) pancreatic and endocrine disturbances; (6) nervous irritability.

Of the organic type of diarrheas, the chief causes are: (1) Toxic substances, such as poisonous drugs; (2) infections, such as bacillary dysentery and tuberculosis; (3) parasites; and (4) ulcerative lesions.

Test Diets

Just as test diets are important aids in diagnosing diseases of the stomach, so is a test meal important in diseases of the intestinal tract, especially in the diarrheas. The Schmidt test diet, consisting of weighed amounts of soft-cooked eggs, roll or bread, butter, cocoa, oatmeal gruel, mashed potato and chopped meat, is almost universally used for this purpose. It will be noted that it contains protein, fat and carbohydrate. Tests are made to determine the ability of the intestine to digest each of these nutrients.

Dietary Treatment

Many physicians have found that the test diet is valuable also as a remedial measure, improvement often occurring before the test is ended. Therefore, modifications of it have been developed for remedial purposes. The following is typical:

MODIFIED SCHMIDT DIET

Foods Allowed:

Meats—Tender steaks (or chopped meat), chicken, fish
Dairy products—Butter, soft-cooked eggs
Vegetables—Mashed potatoes, puréed vegetables
Cereal products—Gruels, crackers, bread, rolls
Desserts—Scraped apple, sponge cake, gelatin dessert
Beverages—Tea (no cold drinks)

To Be Avoided:

Raw vegetables and fruits except scraped apple
Foods containing high roughage
Seasonings other than salt
Milk

TYPICAL MENU

BREAKFAST

Oatmeal gruel
Egg, soft cooked
Toast
Butter
Tea

DINNER

Potato soup
Chicken
Peas purée
Soda crackers
Butter
Gelatin dessert
Tea

SUPPER

Farina gruel
Soft-cooked egg

Roll
Butter
Sponge cake
Tea

It will be noted that milk is omitted from this diet. That is because it was found by animal research[4] that milk, raw or cooked, left a large amount of residue in the lower bowel, although the casein of cottage cheese left little. Raw egg albumin also left a large amount of residue, while hard-cooked eggs were well digested. Lean meat was also without residue.

The above diet, also called by some residue-free, is prescribed for cases of severe diarrhea and following surgery of the lower bowel.

While the causes of diarrhea differ materially, the dietary treatment is similar in most of the types: either the Schmidt diet, as outlined above, is given or the smooth low-residue diet, as outlined below. They are similar. Neither diet is adequate nutritionally and, if followed for any length of time, must be supplemented with vitamin concentrates.

SMOOTH LOW-RESIDUE DIET

Foods Allowed:

Meats—Scraped beef, chicken, sweetbreads
Dairy products—Milk, boiled or skimmed, 3 glasses a day. Cottage and bland cream cheeses. Butter and cream as desired. Eggs, soft cooked, poached, soft scrambled
Vegetables—None—later, purées
Cereals—Only cooked cereals, such as cream of wheat, farina, strained oatmeal and gruel
Breads—Enriched white bread 24 hours old or toasted
Italian pastes—Macaroni, spaghetti, rice, noodles
Soups—Strained cream soups only
Desserts and pastries—Custards, rice, tapioca, cornstarch and bread puddings, plain ice cream, jelly, strained honey and sirup
Beverages—Coffee, tea. Water—Five glasses (1,000 cc.) daily between meals
Vitamin supplements—Wheat germ, brewer's yeast or synthetic concentrates.

TYPICAL MENU

BREAKFAST

Cream of wheat
Milk, 1 glass
Egg, poached
Toast, white
Butter
Coffee or substitute
Cream

DINNER

Cream of potato soup
Crackers
Scraped-beef patty
Buttered noodles
White bread or toast
Butter
Gelatin dessert with whipped cream
Tea or coffee or substitute

SUPPER

Creamed sweetbreads on toast
Jelly sandwich
Cornstarch pudding with chocolate sauce
Milk, 1 glass, or cocoa

There is reason to believe that thiamine plays an important role in the normal functioning of the intestinal tract. When diarrhea persists over a long period of time, it may be advisable to increase the intake of thiamine either orally or intravenously, otherwise deficiency states may develop.

There are some types of diarrhea which require special dietary treatment. Among these are sprue and colitis, which are discussed in the following paragraphs.

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[4] Hosai, K., W. C. Alvarez and F. C. Mann: Arch. Int. Med. **41**:112, 1928.

SPRUE

Sprue, known also as idiopathic steatorrhea, was formerly thought to be a tropical or subtropical disease, but it is now frequently seen in the temperate zone. The etiology is uncertain. By some it is thought to be a gastro-intestinal infection; by others, a deficiency disease; and by still others, a disorder primarily of absorption of the small intestine.

Characteristics. The disease is characterized by diarrhea, with the passing of at least 2 or 3 stools daily. These may be of a soft, mushy consistency or they may be foamy and light colored and have a sour odor. They contain a high percentage of fatty acids and soaps, resulting from imperfect digestion of the fats. For this reason the term idiopathic steatorrhea is often applied to this and similar diseases, such as celiac disease (see Chap. 35).

The tongue and the mouth are often so sore that eating is difficult. Anemia is also a common symptom and, in the later stages, osteomalacia.

Dietary Treatment

The dietary treatment is similar to that for celiac disease. Protein becomes the chief nutrient of the diet because fats and starches are poorly assimilated. Scraped beef, milk in some form and fresh fruit are the foods usually prescribed in the beginning of the treatment. One only of these foods constitutes the initial treatment. Gradually other foods are added, but rare lean meat of beef, lamb or poultry should form the principal part of the diet. The fruits most frequently prescribed are strawberries or bananas, or a combination of the two. The carbohydrate of the banana is well utilized. Orange juice and tomato juice are usually recommended, but other carbohydrates and fats must be added only after the stools have become normal.

To combat the anemia, liver extract and iron are given. Recently folic acid, a synthetic fraction of the B complex, has been found to be effective in the treatment of anemia associated with sprue as well as with other macrocytic anemias. Calcium compounds and vitamin D (in tablet form) are also prescribed to prevent changes in the bony structure. Thiamine and ascorbic acid may also be given. In some cases vitamin K should be given, but in this disease it must be administered parenterally as it cannot be absorbed when given in the usual fatty medium by mouth.

COLITIS

Strictly speaking, colitis is an inflammation of the colon and may be functional or organic in origin. The functional types are (1) simple colitis and (2) mucous colitis. Ulcerative colitis is of organic origin.

Simple Colitis

The term simple colitis is commonly used for what might properly be called irritable or unstable colon. It is characterized by hypertonicity or spasm; by hypermotility resulting in diarrhea; and by the secretion of mucus.

The symptoms are abdominal discomfort, flatulence, distention and diarrhea. At times constipation may precede the diarrhea.

This type of colitis may be caused by disorders of the nervous system, by the improper use of cathartics, enemas and irrigations, or by unsuitable foods and food habits.

The diet should be free from roughage, spices and other irritants. The modified Schmidt is a good initial diet and should be followed by the bland diet. Frequently high caloric additions are indicated.

Mucous Colitis

Mucous colitis is characterized by the passage of large quantities of mucus and by constipation. The passage of mucus is sometimes accompanied by severe colic. The cause is considered to be of nervous origin. The treatment consists of the expulsion of the mucus by therapeutic measures and the correction of the constipation. Rest and relaxation are important.

The dietary treatment is the same as for simple colitis.

Ulcerative Colitis (Colitis Gravis)

Ulcerative colitis is characterized by severe inflammation and ulceration of the mucosa. The cause is unknown. Some consider it to be of infectious origin; others believe that it may be of psychogenic origin; and still others regard it as a deficiency state in which several of the vitamins and possibly proteins of high biologic value are lacking. The symptoms are diarrhea with increased peristalsis and spasm, fever, emaciation and the ulcerative lesions. For these reasons the diet should be of as high caloric content as the patient's condition will allow, and should give the minimum of irritation to the affected part. Protein foods, especially meat, fish and fowl, should form an important part of the diet. Milk is not well tolerated by many of these patients. If given at all, it should be evaporated or at least boiled. The following outline is suggested:

ULCERATIVE COLITIS DIET

Characteristics—The bland diet with the following modifications:

1. Two or three supplementary feedings a day
2. No raw milk
3. All vegetables are puréed except tender asparagus tips
4. Fruits with skins or seeds are puréed
5. Sugar in moderation only
6. High protein, using chiefly meat, fish and poultry

Foods Allowed:

Soups—Consommé, bouillon and other clear meat soups

Meats—All tender beef, veal, lamb, fowl, fresh fish, canned salmon, tuna

Eggs—Any style except fried

Dairy products—Cheese: cottage, cream or Swiss; butter; heavy cream

Vegetables—Potatoes in all forms except fried, asparagus tips, puréed peas, beets, carrots, string beans, squash, spinach

Fruits—Applesauce, baked apple without skin, ripe or baked banana, diluted fruit juice, canned pears, peaches and peeled apricots

Breads—Enriched white bread, toast, zwieback

Cereals—Farina, oatmeal gruel, puffed rice, rice krispies, corn flakes, rice, noodles, spaghetti

Desserts—Fruits as above, gelatin, sponge and other plain cakes

Beverages—Tea, warm fruit juices

Vitamin concentrates — Wheat-germ preparations, yeast, cod-liver oil, viosterol, ascorbic acid for intravenous injections

To Be Avoided:

All fried or fatty foods, including gravies

All spices and seasonings (mustard,

pepper, vinegar, catsup, horseradish, relishes, prepared meat sauces)
All canned, smoked and preserved meat and fish, except as noted
All pork
All raw and dried fruits and vegetables, except as noted
All pastries, preserves, nuts and candies
All stimulants and carbonated waters
All iced drinks

TYPICAL MENU

BREAKFAST

Applesauce
Farina
Heavy cream
Egg, soft cooked
White toast
Butter
Tea

DINNER

Chicken broth with rice
Roast beef
Mashed potatoes
Carrot purée
White bread
Butter
Canned pears
Tea

SUPPER

Baked salmon
Boiled potato
Asparagus tips
White bread
Butter
Sponge cake
Whipped cream
Fruit juice, warmed

DIVERTICULOSIS: DIVERTICULITIS

Diverticula, or small pouches, sometimes appear at weak points along the walls of the intestines. They may occur in the small intestine but are much more frequently seen in the colon. They may be few or many. In the latter case, the condition is known as diverticulosis and may or may not be a source of trouble. When these pouches become infected or irritated, the condition is known as diverticulitis. This condition usually occurs in people past middle life and in persons suffering from chronic constipation and addicted to the use of cathartics. Fecal concretions are likely to accumulate in these pouches and result in infection and sometimes in ulceration and perforation. In the latter case, surgery is usually indicated. In diverticulitis without perforation but with pain, tenderness and fever, the treatment indicated is much the same as for appendicitis, i.e., complete abstinence from food for 24 to 48 hours with only sips of water or cracked ice. Gradually liquid foods are added, then a soft diet, followed by a bland diet. When diverticulosis has been diagnosed, even though without acute symptoms, the patient should be put on a nonconstipating diet, such as is described for spastic constipation.

FLATULENCE

Flatulence is a rather common symptom of indigestion or other types of digestive disturbances. While it is not really serious in itself, it is disturbing to the patient and may accompany some disorder which should be investigated. By flatulence is meant the distention of the stomach or intestines by gas, which may be discharged either by belching or by the passing of flatus from the rectum. Until recently it was thought to be due to fermentation of foodstuffs within the digestive tract, but according to Kantor[5] and Alvarez[6] this is not the common cause. Most of the gas is nitrogen from swallowed air, such as often occurs when one is drinking from a cup or when one chews gum. It may, however, be due to the eating of certain foods which have been found to produce gaseous distress in many people. These are onions, cooked cabbage, raw apples, radishes, dried beans, cucumbers, milk, fatty or rich foods, melons, cauliflower, chocolate, coffee, lettuce, peanuts, eggs, oranges, tomatoes and strawberries.

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[5] Kantor, J. L.: Ann. Int. Med. 3:403, 1929.

Flatulence may also be caused by overeating, by colitis, diarrhea, cholecystitis and by food allergy, as well as by some other less frequent complications such as anxiety and pain.

The treatment will of course depend upon the diagnosis as to the cause. Temporary relief is often given by the eating of small meals with the omission of the foods listed above.

REVIEW QUESTIONS

1. A patient complains that he is continually constipated. What rules would you suggest to him to follow in order to overcome this condition? Outline the diet he should use. What foods are particularly valuable?
2. A highly nervous individual says that she has been constipated. What type of diet would probably be suggested for her? Why?
3. Plan a diet for a patient who has had diarrhea of long duration. What foods should be avoided? What measures must be taken to see that the patient receives adequate nutrition?
4. What are the characteristics of sprue? How is this condition treated?
5. Calculate the protein, the calories, the calcium, the iron and the vitamins in a bland diet for one day. Does it meet the requirements for adequate nutrition of a moderately active man?
6. A patient has had ulcerative colitis for some time. Plan a diet for him for one day. What are the characteristics of this diet?

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[6] Alvarez, Walter C.: J.A.M.A. 120:21, 1942.

27

Diseases of the Liver and Biliary Tract

Chapter Topics

FUNCTIONS OF THE LIVER AND THE GALLBLADDER
- ROLE OF THE BILE
- REGULATION AND STORAGE
- RELATION TO DETOXICATION

PATHOLOGIC CONDITIONS
- SYMPTOMS

DISEASES OF THE LIVER
- HEPATITIS
- CIRRHOSIS
- DIETARY TREATMENT

DISEASES OF THE GALLBLADDER
- FAT CONTENT OF ILLUSTRATIVE FOODSTUFFS

FUNCTIONS OF THE LIVER AND THE GALLBLADDER

The liver is not only the largest glandular organ of the body but one of the most important because of the diversity of functions which it performs, yet it is known as the "silent" organ because its owner is seldom aware of its presence or its functioning. It may well be compared to a modern industrial plant, performing within its confines processes of manufacturing, storing, routing and distributing, and, finally, disposal of several types of waste products.

Role of the Bile

One of the most important functions of the liver is the manufacture of bile, which plays a very important role in the process of digestion, particularly of the fats, as these are emulsified by it and prepared for further digestion. The bile, which is composed of bile salts and acids, color pigments, lipids, mucin and water, is formed by the liver. Approximately 1-1½ quarts of bile are produced daily. Bile is secreted into the intestine under the stimulus of food, especially fats, or under a psychic stimulus. During fasting there is very little or no flow of bile. The bile is also a carrier of waste products, such as the bile pigments, which are finally excreted with the feces of the intestinal tract. The bile probably prevents or at least limits intestinal putrefaction. The delivery of bile into the intestine is accomplished by means of a system of ducts: the hepatic duct leads away from the liver and unites after a short distance with the cystic duct coming down from the gallbladder, and these two, united into a common duct, carry the bile into the intestine. A slight control is exerted over the flow of the bile by the sphincter of Oddi at the entrance to the intestine, and a slight propulsive force is exerted by the liver and the gallbladder. (See Fig. 69.)

The gallbladder concentrates the bile four to ten times by water absorption. It also acts as a tiny storehouse for this viscid fluid, thus maintaining a reserve supply. Contraction of the gallbladder is induced by the hormone cholecystokinin, which is formed when fatty foods mixed with gastric juice come in contact with the duodenum. This contraction causes the bile to flow into the digestive tract. The bile salts which are absorbed from the intestine and returned to the liver to function again also stimulate the bile flow. The greatest stimulants among foods of gallbladder activity are those containing fats, especially those of high cholesterol content (see list, p. 327). Next to fats, proteins are most stimulating, especially meats and their extractives. Carbohydrates appear to have little or no action upon bile flow.

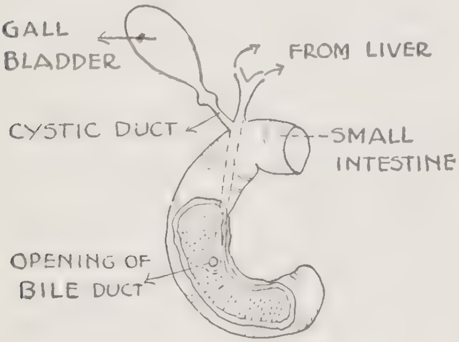

Fig. 69. The hepatic duct from the liver unites with the cystic duct from the gallbladder, forming a common bile duct opening into the small intestine.

Regulation and Storage

The liver controls the distribution and the storage of the amino acids (see Chap. 10). It also contributes to the regulation of the amount of amino acids and urea in the blood at the normal level which is maintained in health. It synthesizes some of the amino acids coming from the digestive tract and derived from the food proteins into the plasma proteins in albumin, fibrinogen, prothrombin and globulin. Some amino acids are distributed by the blood to the tissues, where they are utilized in tissue repair. The excess amino acids are split into the nitrogenous portion which forms the waste product urea, while the remainder may be used or stored as carbohydrate. (See p. 42.)

The liver stores some excess carbohydrate derived from food as glycogen, and since the circulatory system and the tissues normally carry only $\frac{1}{10}$ per cent of glucose, the liver therefore always stands ready again to hydrolyze the stores of glycogen into glucose as the body requires it.

The liver brings about certain changes in fats before they are utilized or stored in the fat depots of the body. The fats may be stored in the liver as well as in other tissues of the body.

When needed, liver fats are again changed to a form that is usable by the tissues.

A very important function of the liver is the role it plays in the metabolism and in the storage of iron and copper, as this organ is the chief storehouse from which they are distributed for use in the hemoglobin of the red cells of the blood. The liver also supplies the antianemic factor which is concerned with the development of the red blood cells in the bone marrow (see Chap. 31).

Recent data have shown that approximately 95 per cent of the vitamin A stored in the body is found in the liver. The conversion of carotene into vitamin A takes place in the liver. Vitamin D is also stored in the liver. The livers of fish are especially rich as storehouses of these vitamins.

It is now known that other vitamins—the B complex, C, E and, to some degree, vitamin K—are also stored there. (See Chap. 8.)

Relation to Detoxication

The liver also performs the function of detoxicating many poisonous substances and changing others into less harmful forms. Two sources of these toxic substances are to be noted: the first, the digestive tract, in foods, ingested bacteria or certain poisons; the second, infections within the body tissues, such as focal infections. Here the liver, like the spleen and other glandular tissues, acts as a bactericidal agent by destroying bacteria that enter through the circulation.

PATHOLOGIC CONDITIONS

It is not surprising that an organ which performs so many functions as the liver should manifest many types of pathologic conditions. Fortunately, the liver if given proper care and treatment has a remarkable reserve power for regeneration and repair.

Symptoms

Jaundice is a symptom of a number of diseases of the biliary tract. It may be obstructive, toxic or hemolytic. In obstructive jaundice there is either a partial or complete exclusion of bile from the intestine due to obstruction of the bile flow at some point, usually of the hepatic or common bile ducts.

Obstructive jaundice, which is by far the most common, is due usually to inflammation in the mucosa of the ducts, to stone formation or to pressure by tumors, lymph nodes or adhesions.

Toxic jaundice may be caused by poisons, drugs and toxemia due to pregnancy and possibly to a virus, as in infectious or epidemic hepatitis (see below).

Hemolytic jaundice, which is much less common, may be caused by diseases in which red blood cells are broken down in the body in large numbers.

When jaundice is present it may be recognized by a yellow pigmentation of the body tissues due to the presence in the blood of more than the normal amount of the bile pigments.

Biliousness. A so-called bilious attack may or may not be related to a diseased liver. It is more frequently caused by overeating, the unwise selection of foods or constipation, although it is known that digestive disturbances are among the more common symptoms of diseases of the liver and the biliary tract.

DISEASES OF THE LIVER

Some of the principal diseases of the liver in which dietary treatment plays an important role are the following: (1) Hepatitis; (2) cirrhosis; and (3) other diseases of the biliary system.

Hepatitis

Etiology and Symptoms. Hepatitis is a general term which may be used to include injury to the liver cells themselves as a result of bacterial or virus infections, toxins and drugs. The most important example of hepatitis is catarrhal jaundice, also called infectious hepatitis or epidemic jaundice. This disease was one of the chief causes of illness among our armed forces of World Wars I and II. It is also prevalent among civilians when living in groups, such as summer camps and boarding schools.

Acute infectious hepatitis is characterized by elevation of temperature, headache, abdominal discomfort and loss of appetite. After a short period, lasting from a few days to 2 or 3 weeks, jaundice may appear. Usually 6 to 8 weeks are required for recovery, but it must be remembered that a chronic condition such as cirrhosis may be the final outcome, this being the experience of many of our soldiers in the Mediterranean theater of war during World War II.

The dietary treatment for this disease is discussed later in the chapter.

CIRRHOSIS

Etiology. This is the end stage of injury to the liver. It is due to a number of causes, the most prominent of which are thought to be chronic alcoholism, chronic biliary-tract infection, and especially the chronic form of infectious hepatitis discussed in the paragraphs above.

The treatment of this condition is the same, regardless of the causative agent or type of injury.

DIETARY TREATMENT

The dietary treatment of liver diseases has undergone radical changes in recent years. It is now based on the assumption that lack of proper nutrients predisposes the liver to the action of toxins of various kinds, many of which find their way to the liver which in normal condition detoxifies them. This has been proven by experiments on animals and by clinical observation. Necrosis of the hepatic cells takes place when the composition of the liver is made abnormal by dietary deficiencies. If the diet is changed to supply the needed nutrients, regeneration of the cells may take place or further degeneration is at least prevented. Although there are many causes of hepatic disturbances, it has been found that the same principles of dietary modification are applicable to all with perhaps slight variations.

The characteristics of the present-day concept of dietary treatment is as follows:

1. **High Protein.** Recent research experiments have shown that unless a high protein diet is consumed, the liver is not protected against injury. The protein is also an important factor in the regeneration of the plasma proteins by the liver cells. Therefore a high protein diet is indicated, the quantity varying from 100 to 150 Gm. or more. Barker *et al.*[1] report having given with success 250 Gm. to soldiers in the Mediterranean area. A generous amount of lean meat is usually recommended. It is sometimes difficult for the patient to consume at his regular meals the required amount of protein, in which case supplementary high protein feeding may be given.[2] Tube feeding may also be advisable, but only in case that no varices (varicose veins) of the esophagus, a frequent complication of cirrhosis, are present. During the acute stage of some of the jaundiced conditions, when nausea and drowsiness are present, it may be necessary to give glucose intravenously, followed by liquids of high protein value which are given by mouth and, as soon as possible, by solid foods of high protein value.

2. **Moderately High Carbohydrate.** Carbohydrates have been found to have a protective function in the liver, and are therefore given in abundance. A diet containing 300-350 Gm. of carbohydrate is recommended. However,

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[1] Barker, Col. M. H., Major R. B. Coops and Major F. W. Allen: J.A.M.A. 128:997, 1945.

[2] Perry, Capt. M. E.: J. Am. Dietet. A. 22:110, 1946.

only bland foods are given; for example, bread, cereals, potatoes, nongaseous vegetables, fruits and fruit juices, jams, jellies, honey and plain hard candies.

3. **Medium Fat.** Any abnormal condition of the liver or gallbladder which prevents the normal production or distribution of bile to the intestinal tract may of course interfere with the digestion of fat. If this condition exists, it may be necessary to limit the amount of fat. Recent experiments by Patek,[3] Hoagland[4] and their associates have shown that fat which was formerly thought to be injurious in liver diseases may be consumed in reasonable amounts, from 100-150 Gm. or even more, without any deleterious effects. The fat was shown to make the diet more palatable and in this way the patient was encouraged to eat more food and more calories, which are also very important.

It should be pointed out, however, that the fats included in these experimental diets were mostly those from milk, cream, butter and eggs. No fried foods or rich pastries were allowed. The emulsified uncooked fats are more easily digested than other fats, therefore butter, cream and egg yolk are preferred. Crisp bacon is given occasionally in small amounts to give flavor. No fried foods or pastries are allowed. A table showing approximate fat content of principal foods is given on pp. 327-328.

4. **High Vitamins and Minerals.** Because of the interference with normal absorption due to lack of bile, it may be necessary to increase these nutrients above the normal requirements. Parenteral or oral administration of vitamin concentrates and liver extract may be deemed necessary. Brewer's yeast is also recommended as a food source of the B complex and protein.

5. **Fluids in Abundance.** Fluids should be given generously; at least 6 glasses per day, unless ascites is present, in which event the liquid should be restricted to approximately 4 glasses or less, depending upon the amount of accumulated fluid present. When fluids are restricted, salt should also be eliminated. (See Chap. 30.)

Fruit juices are especially recommended because of their easily digested carbohydrate.

6. **Calories.** In order to supply the amounts of carbohydrate and protein recommended in this diet and also the quantity of fat needed to make the diet acceptable to the patient, it is necessary to give 2,500-3,500 calories except in very acute conditions, when it may be considerably lower. In obesity the caloric value should be decreased.

7. **No Irritating Food or Condiments.** Alcohol is strictly prohibited; condiments such as pepper, spices, horseradish, mustard and catsup are eliminated; but salt may be used, unless ascites is present. Onions and garlic are not permitted. Foods with high roughage content are contraindicated. In acute conditions it may be necessary to restrict to a very low roughage diet. Coffee, tea and cocoa are restricted to limited amounts.

THE DIET

The following diet may be considered typical of the treatment of diseases of the liver:

Characteristics—As given above.

Foods Allowed:

Cereals—All cooked or ready-cooked (except bran)

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[3] Patek, A. J., and J. Post: J. Clin. Investigation 20:481, 1941.

[4] Hoagland, Chas. L., *et al.:* Am. J. Pub. Health 36:1287, 1946.

Italian pastes—Spaghetti, macaroni, vermicelli, noodles
Breads—Whole-wheat or enriched white (toasted or plain), rolls and crackers
Fruits—Fresh, canned or stewed (skins and seeds removed), juices, bananas
Vegetables—Potatoes, boiled, baked or mashed; tomatoes, carrots, peas, wax or string beans, spinach and other greens, asparagus, squash, beets, lettuce, celery
Eggs—1 or more per day, cooked without fat or served as eggnog
Dairy products—Milk, skimmed or buttermilk, 1 quart per day (whole milk if a liberal allowance of fat is permitted); cream, 2-4 oz., if allowed; cottage cheese; butter, 1-3 pats per day if allowed
Meat, fish and poultry—Lean portions only of chicken, beef (scraped), liver, giblets, oysters, shrimp, crab, fish, cod, carp, flounder, brook trout, perch, pike and white fish
Desserts—Gelatin, puddings (rice, tapioca, cornstarch); sherbets, ices, custard, junket, sponge or angel food cake, fruits, jelly, honey and other sweets
Beverages—Tea, coffee or substitute, fruit or tomato juice, malted milk
Vitamin supplements—Brewer's yeast, wheat germ or synthetic B complex

To Be Avoided:

All meats high in fat, such as pork, lamb, duck, fried foods
Rich cheeses
Coarse breads and cereals
Onions, garlic, leeks, turnips, cabbage, cauliflower, cucumbers, radishes
Pastry and rich desserts
Condiments, except salt
Alcoholic beverages

As already stated, a high-calorie, high-protein and a moderately high carbohydrate and fat diet is now prescribed for cirrhosis of the liver. Patek and Post[5] were among the first to suggest this change from the former low-protein, low-fat diet.

The standard diets on pages 325 and 326 by Patek and Post[5] are typical of those now used in the treatment of diseases of the liver.

DISEASES OF THE GALLBLADDER

Since the gallbladder is really an intermediary between the liver and the digestive tract, it is not surprising that not only do its disturbances affect the liver and the intestinal tract but it too is affected by their disorders.

The chief causes of pain and distress in this organ are an infection due to (1) the spread of an intestinal infection or to blood-borne infections coming from such organs as the teeth, the tonsils or the appendix, or to (2) injury due to impaction through the formation of gallstones. This inflammatory condition of the gallbladder is known as cholecystitis. While cholelithiasis is the term applied to gallstone formation, it must be remembered that the latter condition frequently leads to cholecystitis.

Gallstones are made up largely of cholesterol, a component of all animal fats and glandular organs. For this reason foods rich in cholesterol are avoided or taken in minimum quantities only. Therefore a low-fat, low-cholesterol diet has usually been prescribed. More recent studies seem to indicate that cholesterol of the food has little or no relationship to the cholesterol levels of the blood or the bile, so that high cholesterol foods may still be given, provided they are not cooked fats. When fats are heated to high temperatures, as in frying, abnormal by-products are formed. These are difficult to digest and also act as gastric irritants. Even though fats act

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[5] *Op. cit.*

STANDARD DIETS FOR CIRRHOSIS PATIENTS

SEMILIQUID DIET

			Proteins	Fats	Carbohydrates
7 A.M.	Milk	200 cc.	6	8	10
8 A.M.	Cereal (Pablum)	100 Gm.	2	1	11
	Sugar	12 Gm.			12
	20% cream	30 cc.	1	6	1
	Eggs	2	13	10	
9 A.M.	Orange juice	200 cc.			18
10 A.M.	Eggnog				
	Milk	150 cc.	4.5	6	7.5
	Egg	1	6.5	6	
	Sugar	10 Gm.			10
	Brewer's yeast	25 Gm.	12.5	0.5	8.5
11 A.M.	Cream soup	200 cc.	6	14	15
	Mashed potatoes	100 Gm.	2	6	15
	Butter	10 Gm.		8.5	
	Puréed vegetables	100 Gm.			9
	Orange juice	200 cc.			18
12 NOON	Cocomalt	200 cc.	6	10	20
2 P.M.	Eggnog	200 cc.	11	11	17.5
3 P.M.	Orange juice	200 cc.			18
4 P.M.	Cereal (Pablum)	100 Gm.	2	1	11
	Sugar	12 Gm.			12
	Cream, 20%	30 cc.	1	6	1
	Jello	100 Gm.	1		18
	Cream, 20%	30 cc.	1	6	1
	Orange juice	200 cc.			18
5 P.M.	Cocomalt	200 cc.	6	10	20
6 P.M.	Eggnog	200 cc.	11	11	17.5
	Brewer's yeast	25 Gm.	12.5	0.5	8.5
7 P.M.	Eggnog	200 cc.	11	11	17.5
Grand total		Calories, 2,903	116	131	315

The semiliquid diet was used only in the exceptional cases when patients either refused or were unable to take the solid diet. Brewer's yeast was fed in a milknog; the yeast was stirred thoroughly in cold milk and flavored with sugar, vanilla and nutmeg.

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as a stimulus to the production of bile and the emptying of the gallbladder, experience has shown that high fat diets are not well tolerated in biliary diseases. In inflamed conditions, the gallbladder needs rest, therefore avoid stimulation from fats. The fats of choice, however, are the uncooked fats such as cream, butter and cheese, also eggs, which may be cooked without fat. No fried foods or pastries should be given. Wohl[6] summarizes his recommendations for the diet as "bland, easily digested, low fat"; also, "high in protein and carbohydrate, especially when the episodes of acute symptoms are frequent and hepatitis is present."

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[6] Wohl, M. G.: Dietotherapy, Philadelphia, Saunders, 1945.

STANDARD DIETS FOR CIRRHOSIS PATIENTS

SOLID DIET

		Proteins	Fats	Carbohydrates
Breakfast				
Fruit, 18%	1 serving			18
Cooked cereal	200 Gm.	4	2	20
or				
Prepared cereal	30 Gm.			
Sugar on cereal	12 Gm.			12
Eggs	2 only	13	10	
Milk	200 cc.	6	8	10
Toast	60 Gm.	4	1	30
Butter	20 Gm.		17	
Coffee				
Cream, 20%	30 cc.	1	6	1
Sugar	12 Gm.			12
9 A.M. Brewer's yeast	25 Gm.	12.5	0.5	8.5
Milk	150 cc.	4.5	6	7.5
Sugar	12			12
Dinner				
Meat, medium fat	100 Gm.	17	20	
Vegetables, 5%	100 Gm.	1		4
Vegetables, 10%	100 Gm.	2		9
Vegetables, 20%	100 Gm.	3		19
Bread	30 Gm.	2		15
Butter	20 Gm.		17	
Dessert (cake, pudding)	1 serving	5	8	25
Milk	200 cc.	6	8	10
Coffee				
Cream, 20%	30 cc.	1	6	1
Sugar	12 Gm.			12
2 P.M. Brewer's yeast	25 Gm.	12.5	0.5	8.5
Milk	150 cc.	4.5	6	7.5
Sugar	12 Gm.			12
3 P.M. Orange juice	200 cc.			18
Supper				
Soup (Julienne)	200 cc.	4		4
Meat, medium fat	100 Gm.	17	20	
Vegetables, 5% salad	100 Gm.	1		4
Vegetables, 20%	100 Gm.	3		19
Bread	30 Gm.	2		15
Butter	20 Gm.		17	
Milk	200 cc.	6	8	10
Fruit, 18%	100 Gm.			18
Tea				
Cream 20%	30 cc.	1	6	1
Sugar	12 Gm.			12
7 P.M. Milk	200 cc.	6	8	10
Grand total	Calories, 3,591	139	175	365

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It is therefore apparent that the diet in biliary diseases is basically the same as that in diseases of the liver.

If a low-fat, low-cholesterol [7] diet is prescribed, the following foods should be omitted or used in moderation:

Egg yolks, butter, cream
Brains, kidneys, sweetbreads, liver
Fat meats—pork, mutton, lamb, sausage, goose, duck
All fried foods
Oils and salad dressings

Frequent feedings every 3-4 hours are usually recommended, especially in acute conditions.

Other Considerations. It has been pointed out that women more than men are subject to gallbladder disease; that pregnancy and obesity seem to predispose to this condition; that it occurs more frequently in people during or past middle life; that it is frequently accompanied by constipation and bad dietary habits; and that it occurs often in persons leading a sedentary life. For these reasons it is important that persons of middle age, especially women, should exercise regularly and eat moderately to avoid obesity and constipation.

Since patients suffering from liver and biliary disease show an intolerance for fats, foods high in fats should be restricted in quantity or eliminated. For the convenience of the person making out the menu for such cases, the following table showing comparative values is given:

FAT CONTENT OF ILLUSTRATIVE FOODSTUFFS [8]

100-80%

Lard
Olive oil
Cottolene
Salt pork
Butter
Suet

80-60%

Bacon, medium fat
Walnuts

60-40%

Bacon, lean
Ham, fat
Loin chops, fat
Mutton, fat
Pork, fat
Sausage, pork

40-30%

Cheese, plain or cream
Eggs, yolk
Mutton, medium fat
Potato chips
Pork, medium
Peanuts
Cream, heavy

30-20%

Beef, medium fat
Tongue, canned
Ham, lean
Lamb
Mackerel, salt
Olives
Turkey
Steak, porterhouse
Cream, light

20-10%

Beef, sirloin
Cake, fruit, plain
Capon, chicken
Codfish
Crackers, plain
Eggs
Lamb, roast
Steak, round
Steak, sirloin
Salmon, canned or fresh

10-1%

Fish—Bass, herring, pompano, porgy, shad, smelt
Beef, brain, liver, kidney, tongue

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[7] Okey, Ruth: J. Am. Dietet. A. 21:341, 1945.

[8] Diagnosis and Treatment of Diseases of the Liver and Biliary Tract, New York Postgraduate Medical School, 1934.

Beans, Lima
Bread, white or brown, cornbread
Chicken, broilers
Peas, cooked
Potatoes
Milk, whole or condensed
Macaroni
Veal, breast, leg, loin
Oats, rolled
Pudding, tapioca

1-0%

Apples
Beans, Lima, string
Beets, cooked
Bread, whole-wheat or rye
Carrots
Fish—Bluefish, cod, pickerel, haddock, flounder
Gelatin
Hominy
Buttermilk
Cheese, cottage
Egg, white
Oatmeal, boiled
Fruits, oranges, peaches, pears
Potatoes, cooked or sweet
Shellfish, eels, scallops, clams

REVIEW QUESTIONS

1. What are the functions of the liver as an organ of digestion; as an organ of metabolism; as an organ of storage?

2. What are some of the characteristic symptoms of diseases of the liver?

3. A patient is diagnosed as having cirrhosis of the liver with ascites. The doctor orders a high-carbohydrate, high-protein, low-fat diet for him. Explain why such a diet has been ordered.

4. What foods are to be used in the above diet; what ones avoided?

5. When a low-fat, low-cholesterol diet is ordered, what foods should be avoided?

6. Even though fats are restricted in gallbladder diseases, which ones are most easily tolerated and why?

28

Allergy: Skin Diseases

Chapter Topics

ALLERGY AND ITS MANIFESTATIONS
  CLASSIFICATION OF ALLERGENS
  HEREDITY A FACTOR
  FOODS AND ALLERGY
TESTS FOR ALLERGY
  SKIN TESTS
  BLOOD TESTS
  TEST DIETS
TREATMENT OF ALLERGY
  DESENSITIZING TREATMENT
  RESTRICTED-DIET TREATMENT
FACTORS AFFECTING ALLERGIC MANIFESTATIONS
PROGNOSIS
TEACHING THE PATIENT
SKIN DISEASES
  URTICARIA
  ECZEMA
  PSORIASIS
  ACNE VULGARIS
  ACNE ROSACEA

ALLERGY AND ITS MANIFESTATIONS

CLASSIFICATION OF ALLERGENS

Allergy is a condition of hypersensitivity to certain substances which in the great majority of human beings produce no ill effect. This hypersensitivity may be caused by a certain substance in one individual and by an entirely different substance in another.

The offending items comprise a long list,[1] and include:

Inhalants such as pollen, dusts, cosmetics, etc.
Ingestants such as foods, drugs, etc.
Contactants, cosmetics, poison ivy, adhesive, etc.
Infectants—bacteria, fungi, parasites, etc.
Insect and snake bites
Injectants—serums, vaccines, hormones, etc.
Physical reagents—heat, cold, sunlight, effort

Manifestations. Various parts of the body may be affected, and the manifestations include gastro-intestinal symptoms, migraine, asthma, hay fever, skin disorders and many other symptoms.

There are no typical symptoms, as in a communicable disease, partly because very different tissues of the body respond. Among the many symptoms are redness and swelling of the eyes, running of the nose, headache or migraine, asthma, such skin conditions as urticaria and eczema and such gastro-intestinal disturbances as diarrhea, colic and colitis. The fact that so many of the allergic attacks are related to the skin and the mucous-membrane regions is partly explained by the extensive surface areas exposed to contact with the irritating substances or allergens, either directly or by the circulating blood. Swelling or edema of the affected organ or tissue is often an important factor in the symptoms; for example, in lips, eyes and nasal passages, and in the cerebral tissues in allergic headache or migraine. Smooth muscle spasm is also important, as in allergic diarrhea; the action may be combined with edema, as in bronchial asthma.

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[1] Wohl, M. G.: Dietotherapy, Chap. 33 by A. M. Rowe, Philadelphia, Saunders, 1945.

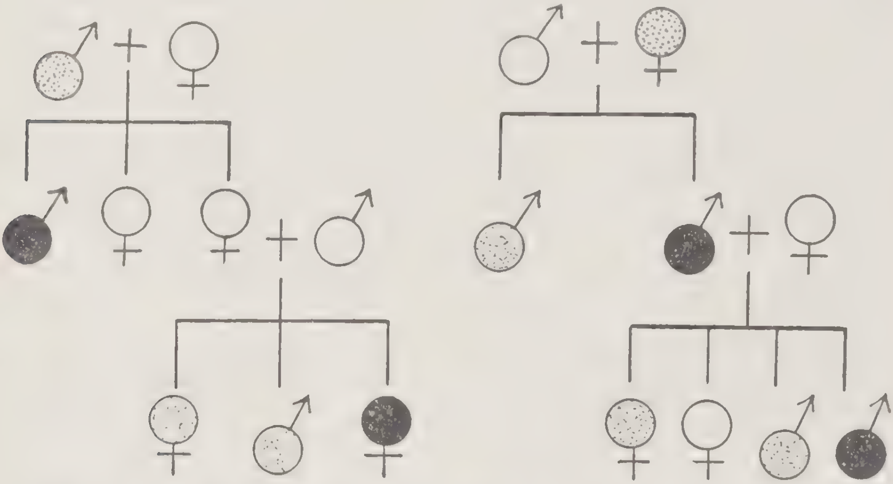

FIG. 70. Two diagrams showing hereditary manifestations of sensitiveness to proteins: black, asthma; stippled, hay fever. The right diagram shows transmission through a sensitive female, ♀. The left diagram shows transmission through a male, ♂: note the transmission to the third generation, although neither of the parents was sensitive. (After Coca, Walzer and Thommen.)

This chapter is, of course, chiefly concerned with food allergies, but it should be borne in mind that any allergy, if severe, may interfere with the nutrition of the individual due to the effect on appetite and thus the general health. This is particularly true of children whose growth and development may be seriously retarded. In such cases the nutrients in the diet should be evaluated carefully and every effort should be made to make the restricted foods as attractive as possible.

Shock Tissues. There are certain organs or tissues in the individual body which are more susceptible to allergy than others. These are called shock organs or tissues, and the symptoms depend in great part upon the tissues which are affected—the skin in hives, the intestines in diarrhea, etc.

HEREDITY A FACTOR

Apparently there is an inherited tendency to allergy which is not specific, and the form which that allergy takes depends upon which organ in the individual is most susceptible. Any organ may be a shock organ, and many diseases of the liver, the stomach, the bladder, etc., are now attributed to allergy due to foreign substances brought into contact with the body.

The record of a French family shows that members of four generations were sensitive to eggs, although in general it is not the specific sensitization which is inherited but the tendency to become sensitive. Experience has shown that in one generation there may be a sensitization to timothy pollen; in another, to strawberries; and in still another, to a different allergen. The allergic reaction does not necessarily manifest itself in the same way in the various members of the family. One may have asthma, another hay fever, another migraine or sick headache, and yet another eczema. (See diagram, Fig. 70.)

One worker reports the following interesting family. The boy, sensitive to wheat, chocolate and strawberry, had asthma. His brother had had the hives. His mother, sensitive to wheat, had suffered in the past from eczema. The maternal grandmother was a victim of migraine, while the paternal grandmother was subject to hay fever from exposure to the pollen of daisy and was also subject to gastro-intestinal disturbances which always followed the ingestion of clams. She would also develop hives after taking quinine. An uncle developed hives after eating strawberries.

Authorities have disagreed as to the prevalence of allergy, but it is now generally believed that approximately 10 per cent of the population show evidences of allergy to one or more substances during life.[2]

Foods and Allergy

Proteins are considered to be the most important factors in food allergy, even though foods which cause such allergic disturbances may vary widely in protein content. Sensitivity to a food such as honey is explained as due to the associated protein in the pollen grains mixed in the honey, for it has been shown that very minute amounts of a given protein may cause allergic reaction. Vaughan and others, however, have stated that the allergic response is not limited to known proteins, but may be caused also by many other substances, including drugs, bacteria and inhalants of various kinds. Unusually sensitive conditions are illustrated by the following cases: An egg-sensitive individual has been made ill by the use of a spoon in his food which had previously been used to stir an egg mixture. A young girl sensitive to black currants was taken violently ill on returning to her home after a short absence from it; it then transpired that the mother had taken advantage of her daughter's absence to make black currant jelly the day of her return and enough volatile substance was present in the house to cause a characteristic attack.

Criep[3] states that among the most common allergy-producing foods are milk, eggs and cereals. Next in order are fish, nuts, spices, vegetables and fruits. Important among vegetables are celery, string beans and Lima beans; and among fruits, bananas, oranges, strawberries and lemons. Over 70 different foods have been listed by various investigators as causes of allergic diseases or disturbances. Some of our most valuable foods are included in these lists, even wheat, milk and eggs; indeed, these three are such common irritants that every discussion of allergic diets includes wheat-free, milk-free and egg-free diets.

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[2] Vaughan, W. T.: J. Allergy 5:184, 1934.

[3] Criep, L. H.: Essentials of Allergy, Philadelphia, Lippincott, 1945.

TESTS FOR ALLERGY

Skin Tests

The case history, including a record of the diet, is important and may suffice for accurate diagnosis, but it is usually supplemented by other diagnostic measures such as the skin and blood tests.

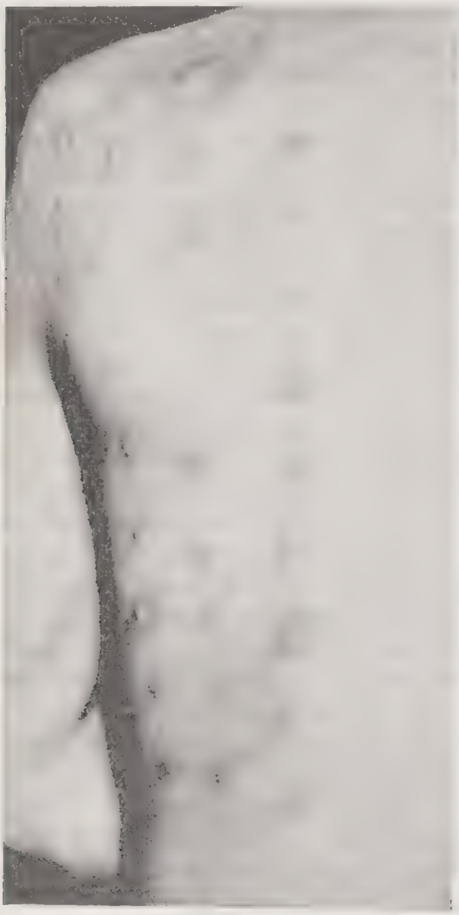

Fig. 71. The wheals or spots on the patient's back indicate a sensitivity to the extracts injected. (J. Warrick Thomas, M.D., Department of Allergy, Cleveland Clinic, Cleveland, Ohio.)

Many years ago it was noted that if pollen were rubbed into the scarified skin of a hay-fever sufferer, an urticarial wheal or hive would develop at the site of the scratch and that this reaction was always produced by the particular pollen to which the sufferer was sensitive. Later it was determined that food substances to which patients were sensitive would usually give similar reactions. This scratch test, now in general use, is carried out by producing a series of scratches on the arm or back, on each of which is dropped a bit of solution containing protein from one of the various probable sources of trouble. In a few minutes most of these scratches will have disappeared, while one or more may develop welts or wheals surrounded by a red or inflamed area. A person is usually found to be sensitive to the substances producing a definite skin reaction. The larger the area over which the welt and the redness spread, the more severe is the reaction and the more probable it is that the food causing the reaction is at least one cause of the patient's allergic attacks (see Fig. 71).

Other skin tests may also be applied; for example, the patch and the intradermal tests.

Patch Test. In this test, the suspected allergen is applied to the skin, is covered by a small square of cellophane and held down by adhesive or other retaining agent. After 2 to 4 days the patch is examined to see if a wheal has appeared indicating a positive or allergic reaction.

Intradermal Test. This test is similar also to the scratch test, except that the food extracts or concentrates are injected into the superficial layers of the skin and they therefore come into contact with the lower and more sensitive tissues. The intradermal or intracutaneous test is considered a more delicate test than the scratch test. A dozen or more substances may be injected at one time, the test insertions being made in one or more rows down the arm, along the spine, etc.

Skin tests are not always successful, partly because the skin may not be as sensitive to a given food as other tissues of the body, such as the mucous membrane. Canker sores in the mouth, colitis and bladder irritation may therefore be due to foods which could not be determined by skin tests.

BLOOD TESTS

Blood changes have been noted in allergic conditions. For example, there may be an increase in eosinophils and a decrease in the total white corpuscle count. These effects have been supported by differences in the blood counts of a patient before and after partaking of allergy-producing foods, but they are not used as routine procedures.

ELIMINATION DIETS (ROWE)

(Second Revision)

Diet 1	*Diet 2*	*Diet 3*	*Diet 4*
Rice	Corn	Tapioca	Milk †
Tapioca	Rye	White potato	Tapioca
Rice biscuit	Corn pone	Breads made of any combination of soy, Lima, potato starch and tapioca flours	Cane sugar
Rice bread	Corn-rye muffins		
	Rye bread		
	Ry-Krisp		
Lettuce	Beets	Tomato	
Chard	Squash	Carrot	
Spinach	Asparagus	Lima beans	
Carrot	Artichoke	String beans	
Sweet potato or yam		Peas	
Lamb	Chicken (no hens)	Beef	
	Bacon	Bacon	
Lemon	Pineapple	Lemon	
Grapefruit	Peach	Grapefruit	
Pears	Apricot	Peach	
	Prune	Apricot	
Cane sugar	Cane or beet sugar	Cane sugar	
Sesame oil	Mazola	Sesame oil	
Olive oil *	Sesame oil	Soybean oil	
Salt	Salt	Gelatin, plain or flavored with lime or lemon	
Gelatin, plain or flavored with lime or lemon	Gelatin, plain or flavored with pineapple	Salt	
Maple sirup or sirup made with cane sugar flavored with maple	Karo corn sirup	Maple sirup or sirup made with cane sugar flavored with maple	
Royal baking powder	White vinegar	Royal baking powder	
Baking soda	Royal baking powder	Baking soda	
Cream of tartar	Baking soda	Cream of tartar	
Vanilla extract	Cream of tartar	Vanilla extract	
Lemon extract	Vanilla extract	Lemon extract	

* Allergy to it may occur with or without allergy to olive pollen. Mazola may be used if corn allergy is not present.

† Milk should be taken up to 2 or 3 quarts a day Plain cottage cheese and cream may be used. Tapioca cooked with milk and milk sugar may be taken.

(Rowe, A. H.: Elimination Diets, Philadelphia, Lea.)

TEST DIETS

Some allergists find that clinical food allergy is somewhat more difficult to demonstrate by means of skin tests than other forms of allergy. Rowe[4] finds the trial or test diets more reliable. These diets are also called elimination diets, the idea being to put the patient on a test diet consisting of only a few foods which are known to be unlikely to produce allergic reactions.

ELIMINATION DIETS

Several elimination diets have been proposed to determine which food is causing the reaction. The patient is fed one or another of the basic elimination diets for a period of 5 to 7 days. Unless the patient becomes symptom-free, he is put on another of the diets for the same length of time. If at the end of the last test, relief has not been obtained, it is evident that other causes than allergy should be sought. If, on the other hand, the patient is relieved of his symptoms on any one of the elimination diets, he is kept on this one week. Other foods are given, one by one, with wheat, eggs and milk last, because these three foods have been found to be the ones most likely to produce allergy. If the patient shows allergic symptoms after the addition of any one food, that food may be suspected as the cause of the allergic disturbance. Many people are allergic to certain vegetables and fruits. Vaughan has found that members of the same botanical group have a similar effect, i.e., Brussels sprouts and cauliflower are likely to cause a reaction if cabbage does, because they are botanically related; likewise, lemons and grapefruit when oranges are allergenic. The basic elimination diets[5] are composed of foods which are least liable to cause allergy.

The following menus are based on the elimination diets by Rowe[6] (see preceding page) as recently revised.

TYPICAL MENUS BASED ON DIETS 1 TO 3

DIET No. 1

BREAKFAST

Grapefruit
Boiled rice with maple sirup
Tea with lemon and sugar

DINNER

Lamb chops
Spinach with lemon
Sweet potato
Rice bread or biscuit
Stewed pear with sugar
Tea with lemon and sugar

SUPPER

Grapefruit juice
Lamb stew (lamb, carrots, rice)
Rice bread or biscuits
Gelatin with lemon juice, sugar and pear
Tea with lemon and sugar

DIET No. 2

BREAKFAST

Stewed prunes
Fried corn-meal mush
Bacon
Tea with sugar

DINNER

Roast chicken
Baked squash
Asparagus
Corn pone
Pineapple, canned
Tea with sugar

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[4] Wohl, M. G.: *Op. cit.*

[5] For special recipes to be used in these diets see Part Three.

[6] Rowe, A. H.: Elimination Diets and the Patient's Allergies, ed. 2, Philadelphia, Lea, 1944.

SUPPER

Sliced cold chicken
Pickled beets
Ry-Krisp
Stewed apricots with sugar
Tea with sugar

DIET NO. 3

BREAKFAST

Grapefruit
Fried potatoes
Soybean muffins (without eggs)
Tea with lemon and sugar

DINNER

Roast beef
Peas
Glazed carrots (in Wesson oil)
Lima-bean bread
Tea with lemon and sugar

SUPPER

Bacon
Stewed Lima beans (seasoned
  with bacon fat)
Potato flour muffins
Peach tapioca
Tea with lemon and sugar

TREATMENT OF ALLERGY

Once the causal foods have been identified by one or more of the preceding tests, two courses are open: (1) To desensitize the patient gradually to those foods or (2) to limit the patient to diets which do not include the irritating foods.

DESENSITIZING TREATMENT

Avoidance of allergy-causing foods is not always desirable. It is difficult, for example, to supply children with the necessary food for growth if wheat or milk is eliminated from their diet. Unless the patient is severely allergic, it may be wise to try to desensitize him to such valuable but for him irritating foods. This treatment, however, should follow a period of complete abstinence from the offending food. Fortunately, it may be possible to desensitize by mouth; and, beginning with doses so minute that they cause no reactions in the person being treated, the amount is gradually increased until ordinary food portions can be tolerated.

To illustrate, one child sensitive to egg white was so desensitized through a period of 7 months by a dosage beginning with $1/_{1,000}$ Gm. dry or powdered egg white. Another child could at first tolerate only such small amount of egg white as that present in a teaspoonful of a dilution made by adding one drop of egg white to a pint of water. In 3 months, however, he was able to include eggs in his diet.

Adults may often successfully desensitize themselves. A man acutely but periodically sensitive to milk so desensitizes himself every 3 or 4 years by taking daily an increasing number of drops of cream until he can again use milk or cream in his coffee, cereals, etc.

RESTRICTED-DIET TREATMENT

The chief means of treating the food-sensitive patient is to restrict the diet to the foods to which the patient is not allergic, and the best means of accomplishing this is to teach the patient as explained later in the chapter.

When persons are sensitive to more than one food, as many allergic patients are, great care must be exercised in planning the diet. It is well to work out a food list so that no available food may be overlooked. If the diet is to be continued for more than 1 week, it is imperative that it be evaluated for protein, calories, minerals and vitamins. Often it is advisable to supplement by mineral or vitamin concentrates, such as calcium lactate or viosterol, by additional quantities of sugars and oils for calories and by increased quantities of the nonoffending protein foods.

Protein hydrolysates are sometimes given as a substitute for milk protein in milk-free diets. Soybean preparations are also used as well as additional meat and eggs.

Vitamin C has been recommended not only as an adjunct to the diet but as a pharmaceutical. Ruskin,[7] who has recently reported the findings of himself and others, recommends large doses of 250-750 Gm. daily, this being 3 to 10 times the normal requirement. He states that "allergic disturbances are related to nutritional deficiencies, primarily that of ascorbic acid." Vitamins of the B complex are also prescribed, as well as Vitamin D, which is thought by many to be especially indicated in cases of asthma.

FACTORS AFFECTING ALLERGIC MANIFESTATIONS

When the food responsible for an allergic disturbance is an unusual article in the individual's diet, such as strawberries out of season, the individual is likely to associate the attack with the related food and is able, therefore, to eliminate the irritating food from his diet.

Whether or not an allergic disturbance follows the eating of a specific food depends in great part upon the individual's physical condition; for example, upon the permeability of the membranes lining the alimentary canal. Drugs, operative shock and constipation are said to affect the tone of the intestinal tissues and allow absorption of food substances which would otherwise be eliminated from the body without any disturbing effects. Emotional strain, chilling and fatigue may also favor the development of an allergic condition. The real or first cause is often hidden, because the sufferer can point to instances where the suspected foods were eaten without ill effects. In some cases the food combinations are important. The patient may overcome one irritating food but probably not two at a time. Often a careful review of the patient's dietary habits will be of great value in determining the exact causes of his difficulties. This review should include a complete history of the case, with the frequency and the severity of the attacks and the relation of the attacks to the seasons of the year. The home environment and the working conditions must also be carefully surveyed for possible factors which might be responsible, such as the presence of dogs, cats, fur, rugs, dust, etc.

PROGNOSIS

Patients are always anxious to know how long the allergic condition will continue. Balyeat [8] says:

"In answer to that question we would say that in some there is a spontaneous loss of sensitivity, but in the majority of allergic patients of various types, whether it be asthma, hay fever, eczema, urticaria, colitis or migraine, whose trouble is due to food, their sensitivity will disappear if the food is left out of the diet over a period of a few months. An occasional patient remains sensitive through life even if the food is thoroughly removed from the diet. Until relief can be obtained, subsequent testing from time to time, at least at 6 month intervals, should be done so that unnecessary avoidance of food is not continued."

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[7] Ruskin, S. L.: J. Dig. Dis. 12:281, 1945.

[8] Balyeat, R. M., E. M. Busten and R. Bowen: Egg-, Wheat- or Milk-Free Diets. Philadelphia, Lippincott, 1933.

There are many instances in which no successful adjustment of the diet of allergic patients has been made, sometimes because of the wide range of foods to which the patient is sensitive and often because of his failure to realize that forbidden foods, such as egg white, may be present in ice cream, baked products, etc. The prognosis, therefore, depends greatly upon the education of the patient as to the conditions he must meet.

TEACHING THE PATIENT

The patient must be made food-conscious of the allergen to which he is sensitive, for even minute quantities often produce attacks. He must beware of commercial products of whose composition he is not absolutely certain. This applies not only to the foods and the drinks purchased over the counter, but to those served in restaurants and other eating places, for prepared foods are often mixtures of various products. Corn muffins, for instance, may also contain wheat.

The wheat-sensitive patient must learn that baker's rye bread contains some wheat flour; that practically all hot breads, griddle cakes, pastries and puddings are made chiefly or partly from wheat products; that bran and gluten are wheat derivatives. Thickened gravies and sauces are to be avoided unless the thickening agent is known. Even meat dishes, such as meat loaf and hamburger steak, may contain bread crumbs; and stuffed meats, such as bologna and sausages, some wheat flour or bread. All malted and cereal beverages must be avoided by the wheat-sensitive person.

The egg-sensitive patient must likewise investigate carefully all commercial products before partaking of them. He must remember that even the baking powder used in baked goods often contains dried egg white; that egg white may be used in the clearing of coffee and in the preparation of foaming beverages; and that most desserts, especially cakes, puddings and ice cream, contain eggs.

The milk-sensitive patient may find that he is able to use milk that has been boiled or dried; but if sensitive to all milk, he must avoid cheese, butter, and margarine, as well as all other foods containing even infinitesimal amounts of milk. Bread as purchased usually contains some milk. Therefore the home-made product is preferable.

When young children are given new foods, such as eggs or vegetables, a second serving of the food should be given within a week, otherwise the child may develop a sensitivity to it. Anaphylaxis may occur if more than 10 days elapse between the first and the second feedings of the new protein.

SKIN DISEASES

Causes. The causes of skin diseases are many, and some of them have not been definitely established. It is fairly well recognized that diet and hygiene have some bearing upon these diseases, but just how and why have not been definitely proven in all of these diseases.

Vitamin deficiencies are known to be accompanied by skin eruptions, discoloration, etc. These have been described in Chapter 22. The treatment depends upon the correction of the deficiencies. Even though definite deficiencies may not be established, many dermatologists advise the use of high vitamin diets with perhaps supplements.

Irritants. It is not surprising that the skin of the body, coming in contact as it does with the outside world and many substances of vegetable, animal and chemical nature, as well as the fluids of the body on the inside, should at times suffer from these contacts. There are many so-called external irritants, such as heat, cold, chemicals, drugs, dyes, vegetable organisms, particularly fungi, animal parasites, feathers, fur and other reagents, which may produce inflammation and disease. The internal causes are much more difficult to identify.

That the health of the organism has a direct effect upon the condition of the skin is generally conceded. Constitutional disorders, such as gastrointestinal disturbances, especially constipation and defective urinary elimination, probably play an important role. Metabolic disturbances involving carbohydrate, fat and protein metabolism have been suspected of being causal factors, and while much research has been done, more evidence seems to be needed in order to establish these theories as specific factors.

There is no doubt, however, that food plays a prominent role in many skin diseases, although its importance as an etiologic factor is sometimes overestimated. As an allergen, however, it may manifest itself in almost any one of the skin disorders. Allergy, not only to foods, but to other substances as well, is a frequent cause. If allergy is suspected tests are made as described earlier in this chapter, and the case is treated according to the findings.

URTICARIA

Hives, as urticaria is more commonly called, is recognized by the wheals which appear on the skin and sometimes on the mucous membranes. Intense itching is a chief characteristic. This condition is one of the most common of the dermatoses and is usually caused by some allergic reagent such as insect bite, serum, drug or physical agents—heat, cold or light. Foods are frequent causes of allergy. If a food is found to be the allergen, the diet must be arranged as already described in this chapter.

ECZEMA

Eczema, a form of dermatitis, may occur in all parts of the body, but it more frequently appears about the flexures—the elbows and the knees—also on the face, and the neck and about the eyes. It is characterized by severe itching, a thickening of the skin with brownish or grayish pigmentation, scaling and the exudation of lymph. It usually occurs in persons somewhat below normal in general health, especially in those suffering from constipation or from kidney complications. Allergy is known to be a causal factor in many cases, especially in infantile eczema.

The dietary treatment should therefore be planned in accordance with the findings. Even though the cause may be due to factors other than food, it is wise to see that the diet is a well-balanced one, simply prepared, easily digested and free from fried or otherwise greasy foods. Candy and other foods high in carbohydrate should be avoided. In cases where the skin is especially sensitive, all possible irritants such as alcohol, condiments and spices should be avoided. Tobacco is also forbidden by many dermatologists.

PSORIASIS

Psoriasis, a condition marked by circumscribed reddened patches covered with adherent white scales, with little or no itching and occurring chiefly on elbows, knees, scalp and back, seems also to be a constitutional disease, the exact etiology of which is not known. Some work has been done which would seem to indicate that nitrogen retention is a factor and that low protein diets are indicated. But results with these diets have been far from satisfactory, especially when continued for more than a very brief period. More recent studies indicate that faulty fat metabolism may be a cause, in which case fat is restricted to about 30 Gm. a day. When a patient is overweight, as many of these cases are, a low caloric diet is advised until a normal weight is obtained.

While little is known as to the specific effect of foods in this disease, it is nevertheless recommended that care be exercised in the diet, the same dietary precautions as for eczema being used.

ACNE VULGARIS

Acne vulgaris is defined as "an inflammation of the sebaceous glands from retained secretions." It is common to oily skins and occurs most frequently on face, chest and back. The lesions consist of pink papules, in the center of which appear little black spots known as blackheads. These may develop into annoying and disfiguring pustules.

Age Incidence. Acne usually appears during or following puberty—from 14 to 24 years of age. It is usually accompanied by a slow circulation and by constipation or other gastro-intestinal disturbances. This condition has been attributed to a high carbohydrate diet and to an excess of bromides and iodides in the blood stream. Wise and Sulzberger[9] therefore recommend care to avoid the use of iodized salt but advocate the use of chlorides (8-15 Gm. of sodium chloride per day) in enteric-coated 1-Gm. tablets, believing this to speed the elimination of these offending salts. Sulzberger has also found that certain foods, especially chocolate, nuts and cheese, are frequent causes of allergic reactions resulting in these skin eruptions. When allergy is the underlying cause, the diet should be adjusted accordingly. For other causes excessive sweets and starchy and greasy foods should be avoided. The diet should consist chiefly of milk, eggs, lean meat, fruits and vegetables. Bread, cereals, light cream and butter in small amounts may be given. All iodine preparations should be avoided.

Some recent research would seem to indicate that vitamin K is beneficial in the treatment of acne.

ACNE ROSACEA

Acne rosacea is a chronic inflammation of the face, especially of the nose. It is characterized by redness and by distention of the capillaries, resulting in an enlargement of the nose. The skin is also thickened. It is usually attributed to the use of alcohol, although it sometimes occurs in total abstainers. As in many of the skin diseases, there is no definite knowledge as to the etiology. Diets high in carbohydrate and in protein have been suggested as causes. Since many of these patients have a low gastric acidity, hydrochloric acid with a diet suitable for hypochlorhydria is beneficial in these cases. Otherwise, a diet suitable for eczema is recommended here also.

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[9] Wise, F., and M. B. Sulzberger: Yearbook of Dermatology and Syphilology, Chicago, Yr. Bk. Pub., 1939.

Alcohol, tea and coffee should be avoided or restricted.

Dermatology is a rich field for research and it is hoped that more definite information regarding causes and treatment will soon be forthcoming.

REVIEW QUESTIONS

1. List seven ways in which allergens may enter the body. Give an example of each.
2. What are some of the forms in which food allergy may manifest itself?
3. What are the three most common food allergens?
4. What means can be taken to diagnose food allergy?
5. Plan a week's menu for a patient who must follow Rowe's Elimination Diet No. 3.
6. If a patient is allergic to milk and wheat, what deficiencies would there probably be in his diet? How could these deficiencies be overcome?
7. A patient is allergic to eggs. List all the possible ways in which he might eat them without realizing it.

29

Cardiovascular Diseases

Chapter Topics

CARDIAC DISEASES	VASCULAR DISEASES
CLASSIFICATION AND ETIOLOGY	ARTERIOSCLEROSIS
TREATMENT	HYPERTENSION
DIETARY MANAGEMENT	DIETARY TREATMENT

CARDIAC DISEASES

Cardiovascular diseases are said to constitute the greatest public-health problem of the present time. More people die from these diseases than any other one cause today. It is important, therefore, to understand the basic principles of treatment, including the modifications to be made in the diet.

Classification and Etiology

There are many classifications of diseases of the heart, such as:

(1) Functional and organic.

(2) Acute and chronic.

(3) Without failure and with failure.

Like most organs, the heart may be affected functionally or organically.

Functional diseases usually express themselves by heart pain and by disturbances in the rate and the regularity of the heart action. These functional diseases are usually benign and rarely produce organic diseases of the heart. The principal causes of these functional diseases are excessive use of tobacco and alcohol, low-grade infections, and very commonly, psychoneuroses.

Organic disease of the heart is caused principally by rheumatic fever, syphilis, thyroid disease, hypertension and arteriosclerosis.

These diseases cause most of the disability due to heart disease and nearly all the deaths resulting from heart disease.

Acute diseases are often due to infections such as occur following rheumatic fever or pneumonia. These infections may affect any one layer or all three layers of the heart—the endocardium, the myocardium or the pericardium.

Chronic diseases are often the result of the acute infections mentioned above and may also affect the various parts of the heart, including the valves.

Heart diseases may for the most part be grouped according to degree of severity as those "without failure" and those "with failure," the latter being the more critical.

Heart failure occurs when the heart is unable to sustain, by its beating, an adequate flow of blood to all the tissues of the body which require food and oxygen continuously. As a consequence of this heart failure the patient becomes sick and begins to show signs of distress when performing the activities which were formerly performed with ease and without discomfort.

The principal signs of distress are shortness of breath and pain in the chest or the upper abdomen. As the heart failure progresses the liver becomes enlarged and edema appears in the dependent parts of the body and sometimes in the pleural and the peritoneal cavities. Finally, coronary occlusion may occur.

PATIENTS WITHOUT FAILURE are those in whom the heart by some means of compensation is able to maintain a practically normal systemic circulation. These of course are the milder cases.

PATIENTS WITH FAILURE are critically ill.

TREATMENT

Regardless of classification, the treatment is much the same, except for the severity of the disease and the restrictions placed upon the patient. For patients without failure, a moderate amount of exercise is permitted, while for those with failure, absolute bed rest is required.

For those without failure the diet is changed only slightly, the object being to supply an adequate diet and avoid additional burdens due to overeating. If, however, the patient is even slightly overweight, the caloric value of the diet should be reduced until the patient is somewhat underweight. Some doctors advise some reduction even in those who are not overweight. By reducing the weight the heart is freer in its movements and the metabolism is decreased, thus furnishing less stimulus to its activity.

The dietary principles for treatment of this type of disease are as follows:

(1) The avoidance of bulky meals to prevent distention of the stomach.

(2) The avoidance of constipation.

(3) The avoidance of such foods as members of the cabbage family, dried peas and beans. These ferment easily, may cause gas in the alimentary tract and result in pressure against the heart.

(4) The avoidance of overeating and increase in weight, both of which throw an extra tax upon the heart and the blood vessels.

(5) The avoidance of any food known to be difficult of digestion.

(6) The avoidance or the sparing use of stimulants. Alcohol, tea and coffee are sometimes permitted.

For patients with failure the diet is much more restricted. In acute heart failure such as coronary thrombosis the patient is allowed no food for 1 to 3 days, with the exception of some fruit juices. Later, milk may be given, but this is usually limited to 800 cc. or approximately 3½ cups, and is given in 4 feedings. This milk diet is usually called the Karell diet. Other liquid foods such as potato soup and cereal gruels may be substituted, but they too are limited to 800 cc. Still later, crackers, toast, soft-cooked eggs, mashed or baked potatoes, vegetable purées, as well as fruits, gelatin dessert, custard and ice cream, may be added, but all these additions must be prepared without salt.

It will be noted that the above diet has three chief characteristics:

(1) It is low in calories.

(2) It is limited in water intake.

(3) It is low in salt content.

The reasons for the above limitations are given under the next topic

Dietary Management

The characteristics of the dietary treatment of diseases of the heart, when accompanied by failure and edema, are as follows:

1. **Low Caloric Value.** As cited in the preceding paragraphs, a low caloric diet is desirable to bring about a reduction in weight and to lessen the heart's activity. The patient should be weighed regularly and the caloric value calculated to determine the need for further reduction. It should be remembered that if edema is present this should be taken into consideration in planning the diet, as this may add many pounds to the body weight.

2. **Protein Normal.** Except for short periods, the diet should contain approximately 1 Gm. per Kg. of body weight. It is believed by some that protein accelerates the cardiac activity. Recent research, however, has demonstrated the need of protein for repair of tissues in other organs of the body, so it would seem inadvisable to reduce it for any great length of time.

3. **Carbohydrate and Fat.** When the caloric value of the diet must be reduced, the reduction should come from both carbohydrates and fats. The carbohydrates, however, should be the chief source of energy as they are more easily digested and leave the stomach more quickly than the fats, thus providing more room for the working heart. The bulky vegetables, however, should be avoided, as they may cause pressure against the heart.

4. **Vitamins and Minerals.** These should be adequate in all cardiac diets. Many consider it advisable to supplement the diet by giving additional thiamine and ascorbic acid, as both have been found effective in these conditions.

5. **Salt (Sodium Chloride) and Water.** These two items are considered together because they are both causative factors in edema. When salt is present, water is held in the body. The average diet of a well person contains about 10 Gm. (⅓ oz.) of salt per day. The salt-poor (low-sodium) diet contains about 2 Gm. of sodium chloride or less than 1 Gm. of sodium. A person with heart disease may be unable to excrete the normal amount, hence the water is held also. It has now been found that sodium is the active factor of table salt or sodium chloride. For this reason salt and other compounds containing sodium, such as sodium bicarbonate or baking soda, must be eliminated.

6. Small meals are advisable to prevent pressure on the heart. The 3 meals may be supplemented by nourishment between meals and in the evening.

The following salt-poor (or low-sodium) diet illustrates these principles:

SALT-POOR OR LOW-SODIUM DIET

Foods Allowed: *

Cereals—Puffed rice, boiled rice, rolled oats, tapioca, Mead's cereal, Ralston's, cream of wheat, shredded wheat, macaroni, spaghetti, Pearled barley

Breads—White bread and rolls prepared without salt; Passover matzoth

Fruits—All fresh or canned; dried apricots, peaches, prunes, raisins

Vegetables—Fresh or canned without salt; also dried peas and lentils

Dairy products—Milk, 1 cup daily or 2 cups if dialyzed; sweet cream, 2 oz.; sour cream, small serving; sweet butter (without salt), pot and cottage cheese prepared without salt

Eggs—1 a day (or 2 if one is substituted for a serving of meat or cheese)

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* This list of foods was selected from the Table of Sodium Content of Foods (see Part Four, Table 4).

Meats—All fresh meats, chicken and turkey (preferably breast meat)

Desserts—Fruit, jello, tapioca and rice puddings; also custards if made with the daily milk allowance

Beverages—Tea, coffee, cocoa, buttermilk or milk * (see milk allowance above), fruit juices

Miscellaneous—White and light brown sugar, nuts (unsalted), shredded cocoanut, fruit jam, marmalade, jelly, honey and sirup

Seasonings—Vinegar, lemon juice, mushrooms, tomato juice without salt, paprika, cinnamon, cloves

To Be Avoided:

All fish, smoked and salted meats

Carrots, spinach, beets, celery, radishes, turnips, cabbage (outer leaves), chard, dandelion greens

All prepared packaged cereals except puffed rice

TYPICAL MENU

BREAKFAST

Stewed mixed fruit
Puffed rice with fruit juice
or ½ cup milk
Egg
Toast
Butter
Coffee
Cream
Jelly

DINNER

Veal chop
Escalloped potato
Peas
Tossed green salad
Bread or toast
French Dressing (unsalted)
Butter
Cherries, canned or fresh
Tea

SUPPER

Cottage cheese
Boiled potato
Sour cream (small serving)
Tomato and lettuce salad
Cinnamon toast
Butter
Banana
Coffee
Cream
Jelly

In addition to the above diet, the following foods may be allowed ad libitum as they are very low in sodium.

Fruits—Apples, apricots, bananas, berries, cherries, currants, figs, grapefruit, grapes, lemons, oranges, peaches, pears, pineapple, plums, rhubarb, watermelon

Miscellaneous—Squash (without seeds), matzoth, maple sirup, honey, sugar

For further additions consult table on sodium content of foods (see Part Four).

OTHER DIETARY PROCEDURES

The practice of restricting fluids in the treatment of heart failure with edema is beginning to be questioned by the medical profession. Some believe that fluid retention is combated still better by giving large quantities of fluids, providing the sodium in the diet is kept low and the minerals in the food have an acid ash (see Acid-Base Balance, Chap. 7, Table 5, Part Four).

Schemm [1] has outlined such a diet which he terms neutral. This diet he says is "not a low-salt or low-sodium or acid-ash diet, but a combination of all three; and the diet reaction is within limits, more important relatively than the total sodium or salt. Therefore, each meal or feeding is balanced, and if any acid-ash item is not eaten, an equivalent basic-ash item must be omitted."

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* Milk is fairly high in sodium. For this reason it is restricted in salt-poor diets unless the sodium content is lowered, which may be done by dialyzing it or filtering it through a membrane. This is usually a laboratory process, but it is probable that it may soon be made commercially.

[1] Schemm, F. R.: Ann. Int. Med. 17:952 1942.

The diet consists daily of 3 basic-ash foods which include:

Milk, 1 pint
Vegetables, 2 servings
Fruit (except prunes, plums and cranberries), 2 servings

Against these are balanced the following, on which no limit is placed:

Eggs, 2
Meat, fish, fowl, 1 serving
Bread or cereals, 5 slices or servings
Prunes, plum, cranberry, as desired

In the beginning stage of the treatment a so-called initial diet is given. This consists of 6 small feedings for the day. The diet is given below.

The following precautions are also advised:

(1) No salt or soda in or on food
(2) No prepared foods containing salt
(3) No salted broth or extra juices or extra milk
(4) No salt substitutes unless approved by the doctor
(5) No soda for "gas"

In addition to the above diet, water is given in rather copious amounts, these determined by water-balance studies. These may vary from 2,500 cc. as a minimum in mild edema to from 4,000 to 5,000 for more severe cases and to from 8,000 to 10,000 cc. in acute dehydration.

Schemm advocates the liberal use of water, which he states relieves the thirst and makes the work of the kidney easier.

INITIAL NEUTRAL DIET (Schemm)

(Six Small Feedings, with Protein 60–70, Calories 2,400)

Food	Wt.	Measure	Food	Wt.	Measure
	Gm.			Gm.	
1. Cereal and cream			2. Eggnog		
Cereal, prepared	15	¾ cup	One egg	...	....
Uncooked	15	1 tablespoon	Milk	100	½ cup
Cooked	100	½ cup	Cream, 20%	100	½ cup
Cream, 20%	100	½ cup........	Sugar and spice	...	....
Sugar	10	2 tablespoons		...	....
3. Fruit, bread and milk			4. Corn soup		
Prunes	100	½ cup	Corn purée	70	⅓ cup
Bread	30	1 slice	Bread	30	1 slice
Butter	10	1 pat	Butter	10	1 pat
Milk	200	1 cup	Cream	70	⅓ cup
5. Eggs, toast and milk			6. Bread and Milk		
One egg	...	....	Milk	200	1 cup
Bread	30	1 slice	Cream 20%	30	1 tablespoon
Butter	10	1 pat	Bread	60	2 slices
Milk	200	1 cup	Butter	15	1 tablespoon
Cream	30	2 tablespoons			

Notes: Whole-wheat bread prepared without salt; butter to be unsalted or washed. Cereal prepared without salt: farina, cornmeal, cracked or ground whole wheat, oatmeal, puffed rice or puffed wheat only. Any one feeding may be repeated or substituted for another, but the two eggs and the milk for the day must be taken. Extra bread, cereal and eggs may be taken if patient is not overweight. When digestion is weakest, prunes should be omitted and the corn-soup feeding replaced by Feeding 6. When digestion is stronger, plums and cranberries may be used in addition to prunes, and chicken, fresh fish or lamb substituted for the egg in 5. Additional Liquids: Weak tea or coffee with sugar; unsalted weak chicken or beef broth. Prunes, plum and cranberry juice well diluted in water 1:4. Water flavored with fruit flavoring (Kool Aid, etc.). Desserts: Clear jello, wine jelly, angel food or sunshine cakes as desired.

VASCULAR DISEASES

ARTERIOSCLEROSIS

Arteriosclerosis, or hardening of the arteries, is a disease of unknown origin. The hardening occurs as the result of (1) a fatty infiltration of the lining of the vessels and (2) the deposition of calcium salts in the same areas. Necrosis occurs and is followed by calcification, resulting in a hardening of the affected tissues with loss of elasticity of the vessels. The larger vessels are the ones most affected, but even the arterioles become sclerotic. This is particularly true of the vessels of the kidneys. When the above condition exists it is, of course, natural that it calls for more pressure on the part of the heart to force the blood through the vessels. It is not surprising therefore to find that hypertension or high blood pressure is associated with this disease.

HYPERTENSION

Hypertension is not a disease entity. It is rather a symptom which may accompany many disorders, especially diseases of the kidneys. It is a problem of major importance in the public-health field, since it is occurring more frequently than formerly and is the chief cause of disability in middle age. It is also the most frequent cause of heart failure in adult life.

The condition known as essential hypertension may be in some way related to a diminution of the blood flow through the kidney. The cause is undetermined, but the disease is compatible with reasonably long life. As a result of hypertension of long standing, cardiac failure, cerebral apoplexy and chronic kidney diseases may occur.

The following table, by Riesman,[2] presents the average blood pressure of men at varying ages. Any pressure that is decidedly above or below these figures is considered abnormal.

AVERAGE BLOOD PRESSURE OF MEN IN THE UNITED STATES AND IN CANADA

Age	Systolic	Diastolic	Pulse Pressure
20.......	120	80	40
25.......	122	81	41
30.......	123	82	41
35.......	124	83	41
40.......	126	84	42
45.......	128	85	43
50.......	130	86	44
55.......	132	87	45
60.......	135	89	46

DIETARY TREATMENT

Since the etiology of hypertension and arteriosclerosis is unknown, it is inadvisable to modify the normal diet to any great extent unless complications such as edema occur. Clinical experience has shown, however, that obesity, which is a frequent complication, is not conducive to progress. The weight therefore should be reduced. The patient should be given a low caloric diet until normal weight is reached and then the required calories to maintain the weight. It is well to avoid excesses in protein, salt and condiments. Stimulants and tobacco should be avoided or used in moderation. Only limited amounts of tea, coffee and cocoa should be used. When edema occurs along with hypertension, dietary restriction is imperative, as described earlier in this chapter (see salt-poor diet).

Some variations in this diet are suggested on the following pages. It remains to be seen how successful they will be when followed over a long period of time.

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[2] Riesman, David: J.A.M.A. **96:**1105. 1931

Recent experimental work has shown that the rigid restriction of sodium in the diet has resulted in a decided reduction in the blood pressure of hypertensive animals and humans. By the use of the rice diet and diets low in sodium, both Kempner[3] and Grollman[4] have recently presented evidence that many hypertensive patients had been greatly helped by a drastic restriction in sodium. (See Table 4, Part Four.)

The Kempner[5] rice diet is a fairly new development in the treatment of hypertensive vascular disease and kidney disease. Kempner[5] reports beneficial results in 138 of 213 patients treated. The diet consists of rice, fruit, fruit juices and sugar and has a caloric value of approximately 2,000 calories, 20 Gm. of protein, 5 Gm. of fat and 460 Gm. of carbohydrate. It contains only 0.2 Gm. of sodium. The fluid intake is limited to 700 to 1,000 cc. of fruit juices, no water being allowed.

Kempner describes the diet as follows:

"The average patient can eat 200 to 300 Gm. or 6½ to 10 ounces daily, which will provide 700 to 1,050 calories. The additional calories required must be supplied by the liberal use of sugar and fresh or preserved fruits. All fruits are allowed, with the exception of dates, avocados and any dried or canned fruit or fruit derivatives to which substances other than sugar have been added. No salt is permitted. All fruit juices are allowed, but tomato or vegetable juices are not given. Brown or white sugar may be used ad libitum. Any kind of rice is used. The rice is boiled or steamed in plain water or fruit juices, without salt, milk or fat."

The diet is also supplemented with vitamins and iron.

This diet of course becomes very monotonous and some patients are put on a modified diet consisting of additions of "nonleguminous vegetables or small amounts of potatoes, lean beef, chicken, fish or eggs (everything prepared without salt or fat)."

Grollman[6] says that "it is very probable that the incidental salt restriction is responsible for the results reported recently by Kempner." Grollman chose foods of very low sodium content and further reduced this factor by including 1,400 cc. of dialyzed milk.

Some very spectacular results have been obtained in the treatment of edema in the last year or so. Many physicians have co-operated in attempting to find the real cause of this ailment and the most effective treatment for it. As a result of their efforts, it now seems generally agreed that sodium is the chief factor concerned and, therefore, the low-sodium diet is the treatment of preference. It is necessary in preparing this diet to calculate very carefully the amount of sodium and to keep it below 1 Gm. It is also believed that water restriction is not necessary with this diet. Many now agree with Schemm[7] that a high fluid intake is even more desirable in the treatment of edema, as it is believed that it facilitates the removal of sodium, the edema-producing factor, from the body.

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[3] Kempner, Walter: North Carolina M.J. **5**:125, 273; **6**:62, 117, 1944-1945.

[4] Grollman, Arthur, *et al.*: J.A.M.A. **129**:533, 1945.

[5] *Op. cit.*

[6] *Op. cit.*

[7] Schemm, F. R.: Lancet **66**:50, 1946.

For tables of quantitative sodium values see Table 4, Part Four, and also consult the following texts:

(1) Sherman, H. C.: Chemistry of Food and Nutrition, New York, Macmillan, 1941.

(2) Bridges, M. A.: Dietetics for the Clinician, Philadelphia, Lea, 1941.

(3) McCauce, R. A., and E. M. Widdowson: The Chemical Composition of Foods, London, His Majesty's Stationery Office, 1940.

REVIEW QUESTIONS

1. A patient has been diagnosed as having heart disease with failure. What diet would probably be prescribed for his treatment? Why?
2. How much salt is there in a salt-poor diet? Why?
3. What foods should a patient on a salt-poor diet avoid?
4. What is the usual treatment for hypertension?
5. What newer diets have been proposed for hypertension?

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Diseases of the Urinary Tract

Chapter Topics

- FUNCTIONS OF THE KIDNEYS
- NEPHRITIS
  - ACUTE NEPHRITIS
  - CHRONIC NEPHRITIS
- NEPHROSIS
- UREMIA
- URINARY CALCULI
- INFECTIONS OF THE URINARY TRACT

FUNCTIONS OF THE KIDNEYS

The kidneys have been described as the "excretory servant of the body." Their chief function is to preserve the normal composition of the blood. They respond to the changes in the blood which occur both in health and in disease by changing the concentration of substances in the urine and thus preserving the normal composition of the blood. Practically all the waste products resulting from metabolism are carried by the blood to the kidneys, where the blood is filtered and the waste products are eliminated. The kidneys are subject to many diseases, the principal ones being infections, diseases of the vascular system and diseases of metabolism.

The kidneys are indeed a great filtering plant, provided as they are with about two million units called nephrons or renal units, each of which contributes its mite to the performance of this function. The nephron consists of a tuft of capillaries—the glomerulus—surrounded by a covering or capsule which merges into a long winding tubule. The fluid which filters through the glomeruli is a protein-free filtrate of the blood plasma. This passes through the tubules, where some of it is reabsorbed and changed; the remainder passes on through the collecting tubules into the pelvis of the kidney. This fluid is the urine which is passed by the ureters into the bladder, where it accumulates and in due time is eliminated from the body. (See Figs. 72 and 73.)

Water is by far the largest waste product, the quantity varying mainly with the amount taken into the body and the amount excreted by means of the skin and the lungs. Normal urine contains only about 5 per cent of solids, consisting of salts, both basic and acid, and the end products of protein metabolism, of which the largest constituent is urea. If, for any reason, these products are not eliminated, they are then found in abnormal quantities in the blood. A blood chemistry test, therefore, is often a determining factor in the diagnosis of kidney diseases.

NEPHRITIS

Nephritis is a general term used to denote disease of the kidney due to inflammation or to degenerative changes. Different parts of the nephron unit may be affected in varying degree. For example, most cases of nephritis show the principal injury in the glomeruli, but in some cases changes in the tubules or in the supporting tissues may be more prominent.

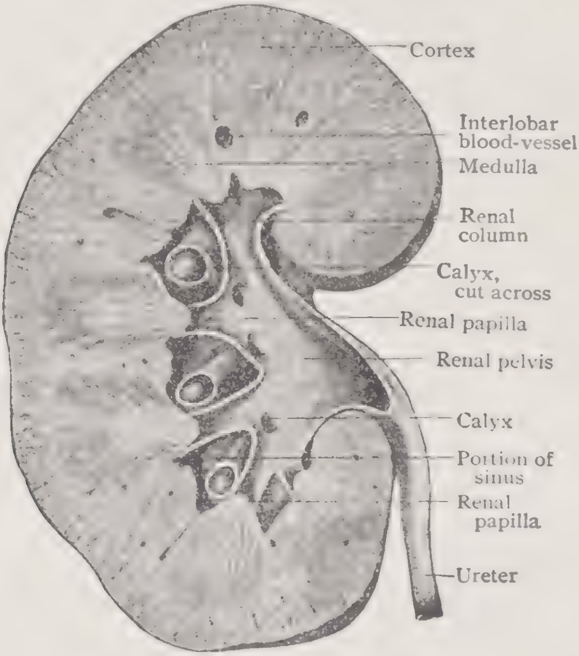

Fig. 72. A section through a kidney showing the cortex more or less striated due to the parallel tubules which merge into the medullary rays sections or medullas. From the apex of each medulla (renal papilla) urine passes into the renal calyx, collects in the renal pelvis, and is finally eliminated through the ureter. (Piersol, G. A.: Human Anatomy, Philadelphia, Lippincott.)

Nephritis may be acute, subacute or chronic; and it may be complicated by edema or uremia, the latter being the result of the accumulation of protein waste products in the blood. Nephritis may be of short duration, as in the acute form, or of many years' duration, as in the chronic type. It is evident therefore that there is no one type of diet which is applicable to all kinds of nephritis.

ACUTE NEPHRITIS

Etiology and Symptoms. Acute nephritis is usually caused by an infection following some of the contagious diseases of childhood, such as scarlet fever or chickenpox. It may also follow tonsillitis, sinusitis, diphtheria, pneumonia or influenza, and it may occur during pregnancy. It occurs more frequently in childhood or early adult life than in later years. It is often

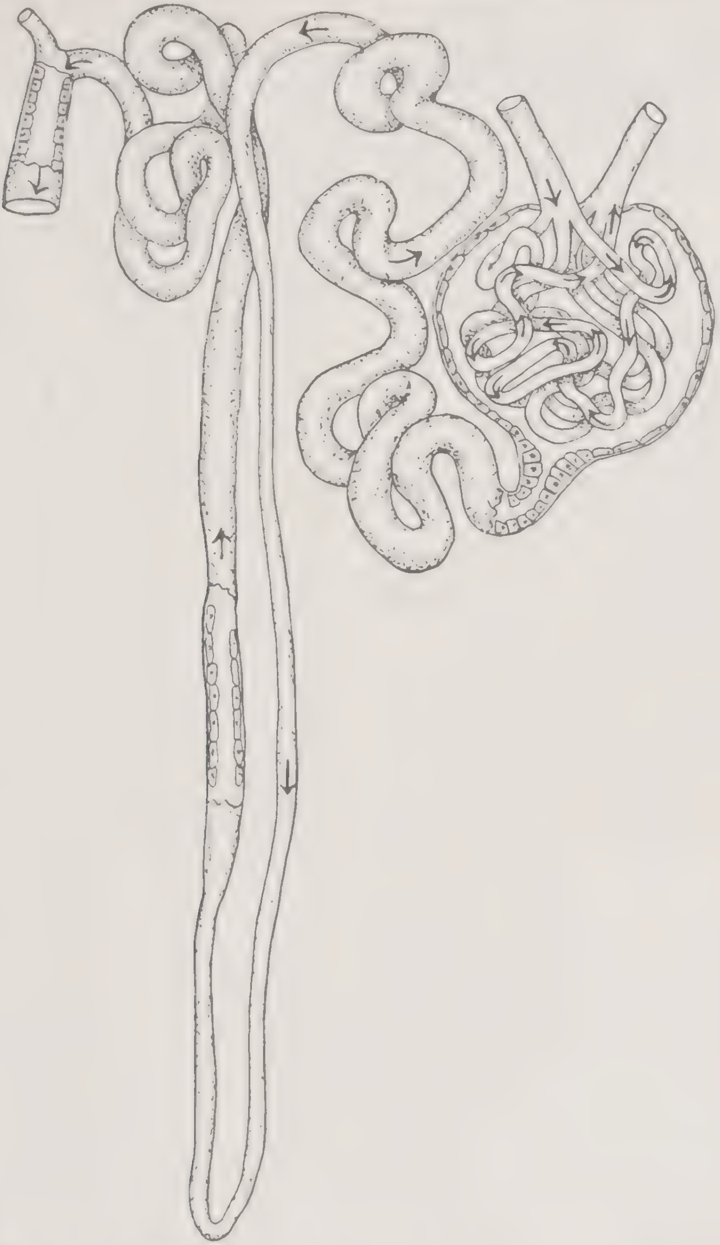

FIG. 73. A wholly diagrammatic drawing of a nephron or a urine-secreting unit, showing the distribution of the capillaries in the capsule or glomerulus, the glomerular cavity in which the urine collects, and the convoluted, looped tubule into which the glomerulus merges. The arrows show the course of the blood in the capillaries and the transfer of the urine from the glomerulus to the final collecting tubule.

characterized by a diminished secretion of the urine, a condition known as anuria; by nausea and vomiting; and by edema and hypertension. The urine contains albumin, casts and oftentimes blood.

DIETARY TREATMENT

The aim in the treatment of such a condition is rest for the kidneys, disregarding if necessary for a few days the general nutrition of the patient. Fluids should be limited to a little more than the output. The total fluids are usually restricted to from 800 to 1,000 cc. Orange or other citrus fruit juices may be substituted for water. As the anuria diminishes the fluids are increased. When edema is present, as is usually the case, the patient is treated in somewhat the same way as for a cardiac condition with edema, i.e., restriction of sodium (see Salt-Poor Diet, Chap. 29). During the first days of the acute illness the patient is given very little food, except the fruit juices mentioned, followed by a milk diet of 3 to 4 glasses daily with later additions of cereals with cream, toast with unsalted butter, jelly or jams and fruits, fresh or cooked. For the first 2 or 3 weeks the protein is restricted. It should be remembered that such a regimen is for a short time only, after which the patient is gradually returned to a normal diet. Many physicians[1] are now inclined to give a more liberal protein allowance—1 Gm. per kg. of body weight—believing that the normal allowance does not retard healing of the renal units as was formerly thought.

CHRONIC NEPHRITIS

Symptoms. Chronic nephritis is insidious in its onset. The symptoms are usually so mild at first that the subject is not aware of his condition until his attention is drawn to it, perhaps when taking an examination for obtaining life insurance. The urine is usually abundant in quantity and of low specific gravity, and it may show much or comparatively little albumin and few casts. There may be morning headache and the patient may be annoyed by the necessity of frequent urination during the night, which indicates that the kidneys are having to work overtime to complete their task. In young people, when hypertension is first evident, this type of nephritis should be suspected. As time goes on, these symptoms become more severe; polyuria develops, the blood pressure rises and arteriosclerosis is apparent. Edema, which is usually present at least to the extent of producing a puffiness under the eyes, may increase and dyspnea may be present. Uremia, like coma in diabetes, is a very serious complication, the treatment for which is described later in this chapter.

DIETARY TREATMENT

In chronic nephritis the dietary treatment must of course be adjusted from time to time as the disease progresses. Because of the great reserve power of the kidneys, no special restrictions need be made in the early stages. Unfortunately, little is known as to the cause of this condition and there is no known cure, dietary or otherwise. It therefore seems important to maintain the body in the best possible condition and so prolong life on the highest possible level. The diet should be ample for maintaining a normal body weight; the protein should also be adequate (80 to 100 Gm.) and of good quality, if the present-day idea is accepted, but in any event it should not be excessive; salt and other sources of sodium should be restricted if edema is present. It is generally conceded that water should not be restricted, as it is necessary for the removal of the toxic products of the kidneys. To the contrary, it is often increased to as much as 4 to 6 liters. Foods rich in vitamins are indicated as deficiencies in riboflavin, ascorbic acid and vitamin A are known to cause renal damage.

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[1] Murphy, F. D., and B. J. Peters: J.A.M.A. 118:183, 1942.

Fat should be limited to the more easily digested forms with little or no fried foods or rich pastries served, and carbohydrates may therefore be somewhat increased to make up the normal caloric requirement and to spare the protein. Overeating must be avoided, however. Condiments—pepper, mustard, horseradish and spices—should be avoided because of their irritating effects. Alcohol is also prohibited, and both tea and coffee are allowed in limited quantities only.

When the edema is accompanied by the excretion of large amounts of albumin, the protein must be increased to higher levels to make up the deficit.

If, during the course of the disease there is nitrogen retention in the blood, the food protein may be lowered temporarily. The protein-food needs must be balanced against the level of nonprotein nitrogen (waste products) in the blood. When the body is losing its protein in the form of albumin in the urine, this loss must, if possible, be made up by an increase in the protein intake.

In planning the diet, the above restrictions must be kept in mind and must be based upon the condition of the individual patient. The basic dietary pattern, as applied to therapeutic diets (see Chap. 19), should be used as the foundation. Additions or subtractions to meet the caloric, protein and other requirement should be made according to the individual's needs.

NEPHROSIS

Etiology and Symptoms. Nephrosis, known also as degenerative Bright's disease, is a rather rare type of kidney involvement about which there has been considerable discussion in the medical literature. It is characterized by marked albuminuria. Edema and anuria may be present. The blood proteins are low with the globulin relatively high and the albumin comparatively low. There may also be an increase in the lipids or fatty constituents of the blood. There is also evidence of an endocrine disturbance, as indicated by a lowered metabolic rate. In some cases there is marked improvement when thyroid extract is given; in others, when parathyroid extract is administered. These results have led some authorities to believe that the condition is one of disturbed metabolism closely related to myxedema or extreme hypothyroidism. The symptoms usually characteristic of nephritis are lacking, such as hypertension and high urea nitrogen. For the above reasons many clinicians designate this syndrome as a separate disease entity rather than as a type of nephritis.

Dietary Treatment

In nephrosis the dietary treatment aims at making good the loss of serum proteins which are excreted as albumin in the urine. For this reason the chief characteristic of the diet is high protein (100 to 150 Gm.), the amount depending on the quantity excreted.

Excessive protein, however, may be harmful. Salt-poor human albumin has been used effectively in some cases of nephrosis with edema. When there is an excess of lipids (fatty substances) in the blood, the fat in the diet is usually kept low (50 to 75 Gm.). In order to keep the caloric value up to normal it will be necessary to give a relatively high carbohydrate diet.

Most authorities agree that sodium should be restricted, even though edema may not actually exist. Allowance is made for a small amount in cooking, but none is used at table. When edema actually exists, no salt or soda is allowed in cooking. Such a diet will contain approximately 2 Gm. sodium chloride or less than 1 Gm. of sodium. Fluids need not be limited.

For further details concerning the treatment of edema, see the chapter on cardiovascular diseases.

To summarize: The principles of the dietary treatment are (1) moderately high protein, (2) low sodium, (3) low fat and (4) high carbohydrate.

Barborka [2] has outlined diets of 80, 100 and 150 Gm. of protein, one of which follows:

HIGH PROTEIN DIET FOR NEPHROSIS

(150 Gm. Protein, 2,600 Calories)

Suggested Distribution of Total Food Allowance for One Day

BREAKFAST	Gm.
Fruit (1 serving)	100
Cereal, cooked (⅔ cup)	140
Eggs (2)	100
Bread, toasted (1 slice)	30
Sugar (2 tablespoons)	30
Jelly or jam (3 tablespoons)	45
Milk, skimmed (½ glass)	100
LUNCH	
Meat (1 extra large serving)	225
Potato or substitute (1 serving)	100
Vegetable (2 servings)	200
Bread (1 slice)	30
Jelly or jam (3 tablespoons)	45
Fruit (1 serving)	100
DINNER	
Meat (1 extra large serving)	225
Potato or substitute (1 serving)	100
Vegetable (1 serving)	100
Fruit salad (1 serving)	100
Bread (1 slice)	30
Jelly or jam (3 tablespoons)	45
Fruit (1 serving)	100

UREMIA

Uremia, while not a disease entity, is a clinical complication, which often occurs in nephritic diseases. As the name would indicate, it is characterized by a greatly increased quantity of urea in the blood. Other end products of protein metabolism—uric acid, creatine and creatinine—also accumulate; but the urea is by far the greatest of the waste products and the nitrogen from this source, known as urea nitrogen, is an index of the severity of the condition. The symptoms are headache, coated tongue, foul breath, dizziness, nausea, muscular twitchings, convulsions and coma, the last usually being fatal in nephritis. The treatment is, of course, directed toward the elimination of the toxic products in the blood stream.

DIETARY TREATMENT

In uremia, fluids are usually forced and may be given intravenously or by rectum. Salt is restricted only if edema is present. It may be added if by prolonged vomiting the body chlorides have been depleted. The diet prescribed is usually low in salt, high in carbohydrate, restricted in protein (50 Gm.) and adequate in fluids.

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[2] Barborka, Clifford J.: Treatment by Diet, Philadelphia, Lippincott, 1947.

URINARY CALCULI

Etiology. Calculi or stones varying in size from fine gritty particles to those which fill the pelvis of the kidney sometimes may form in either the kidney or the bladder. They are caused in part by injury to epithelial cells lining the kidney tubules and also by changes in the chemistry of the urine. The most striking example of the former cause is seen in hyperparathyroidism, in which disease oversecretion of para-thor-mone (parathyroid extract) injures the kidney epithelium and stones are formed.

Normally the urine is slightly acid and when it becomes alkaline, either from an excess of foods rich in the alkaline elements (see Acid-Base Balance, Chap. 7) or from infection, stones composed chiefly of the oxalates, phosphates and carbonates may occur. Uric-acid and cystine stones develop in an abnormally acid urine. The former type occurs much more frequently than the latter. When phosphates predominate the condition is known as phosphaturia; when oxalates predominate, as oxaluria.

Dietary Treatment

There is much evidence that the dietary habits are important factors in calculous disease. Experimental work has shown that a diet deficient in vitamin A will produce calculi in a large percentage of animals. Urinary calculi occur much more frequently in the Old World than in the New, especially in certain parts of India and China, where the diet is known to be deficient.

Vermooten[3] observed that the South African Negro, whose diet is rich in vitamin A, low in calcium and has an acid-ash reaction, is entirely free from this disease as judged by hospital records of over one million Negro patients.

This statement lends credence to the work of Higgins[4] who, by careful control of the diet, not only was able to change the reaction of the urine, and thus prevent further stone formation, but also facilitated the dissolution of small stones already formed. He found that a suitable diet usually prevents recurrence, whereas stones previously were known to recur in 15 to 20 per cent of cases operated upon for calculi. Other clinicians,[5] however, do not report such favorable results. For the type of calculi found in alkaline urine, Higgins recommends a diet such as is outlined below which will change the reaction of the urine from an alkaline to an acid one, if the stones are soluble in acid, and which will also improve the general conditions of the diseased organ:

HIGH-VITAMIN, ACID-ASH DIET[6]

Characteristics:

1. No added salt (sodium chloride) or bicarbonate of soda
2. Generous use of foods high in acid ash
3. Restricted use of foods high in alkaline ash
4. Vitamin concentrates—cod-liver and halibut-liver oils, yeast and wheat germ

Foods Allowed:

All acid-ash foods
Meats, fish and poultry

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[3] Vermooten, V.: J.A.M.A. **109**:858, 1937.

[4] Higgins, C. C.: J. Am. Dietet. A. **11**:518, 1936.

[5] J.A.M.A. **109**:1703-1712, **121**:566, 1943.

[6] Condensed. For full particulars see J. Am. Dietet. A. **11**:518, 1936.

- Eggs and cheese
- Bread, whole-wheat
- Cereals, preferably whole-grain
- Macaroni and spaghetti
- Cranberries
- All neutral-ash foods:
  - Sweet butter, lard, salad oils, mayonnaise; tapioca, cornstarch; sugar, candy (except chocolate); tea, coffee, Postum
- All alkaline-ash foods (except as noted) in minimal amounts:
  - Fruits
  - Vegetables
  - Milk (1 pint daily)
  - Cream

Avoid:

- Molasses
- Almonds, olives
- Spinach, beet and dandelion greens, parsnips
- Dried fruits and vegetables

TYPICAL MENU

BREAKFAST

- Grapes
- Oatmeal and 2 tablespoons wheat germ
- Scrambled eggs
- Toast, whole-wheat, 2 slices
- Butter, 2 squares
- Milk, ½ pint
- Cream, ¼ cup
- Sugar
- Coffee

LUNCHEON

- Veal chop
- Steamed rice
- Sliced tomatoes
- Baked apple
- Whole-wheat bread, 1½ slices
- Butter, 2 squares
- Milk, 1 glass

DINNER

- Roast beef
- Potato
- String beans
- Tapioca cream pudding
- Whole-wheat bread, 1½ slices
- Butter, 2 squares
- Cream
- Sugar
- Coffee

NOTE: One pint of milk is to be used each day.

When calculi of the uric-acid or the cystine types occur, which happens less frequently than the type described above, the diet should be high in vitamin A but with an alkaline-ash base. To effect this, the alkaline-ash foods, especially fruits and vegetables, should predominate, while the acid-ash foods, meats and cereals should be restricted. There should always be sufficient protein, however, to meet normal requirements. (See Table 5, Part Four.)

Water should be taken freely in order to prevent concentration of the urine, which in turn favors precipitation of the stone-forming minerals.

INFECTIONS OF THE URINARY TRACT

Infections of the urinary tract, including pyelitis, pyelonephritis and cystitis, may alter the chemical reaction of the urine with the possible formation of calculi, depending upon the type of bacteria present. The *Bacillus coli,* said to be present in three fourths of all cases, produces ammonia and therefore alkalinizes the urine. The same is true of certain other organisms. Still others cause the urine to be acid. In acute infections, the forcing of fluids is of primary importance.

When the infection is chronic, measures are usually taken to eliminate the bacteria through dietary regulation and possibly through medication. The ketogenic (high-fat) diet has been found to be somewhat bactericidal because of the acids formed in the process of oxidation of the fat (for particulars concerning this diet, see Epilepsy, Chap. 32). The patient eats this diet with difficulty, as nausea frequently results. Even the low caloric ketogenic diet is not well tolerated. The present trend is to use the acid-ash (or alkaline-ash) diet in conjunction with some urinary antiseptic such as mandelic acid, sulfadiazine or streptomycin, depending upon the specific organism which is responsible for the infection.

REVIEW QUESTIONS

1. What are the functions of the kidneys?

2. Why does it not seem advisable to restrict proteins in nephritis?

3. A patient with nephrosis has an ideal weight of 65 Kg. and is showing an albuminuria of 10 Gm. per day. What is the least amount of protein he should have in his diet? Why? What other characteristics should the diet for this patient have?

4. Plan an acid-ash diet for a patient for a week. When is such a diet used?

5. Why is a ketogenic diet effective in treating some urinary infections?

31

Diseases of the Blood

Chapter Topics

GENERAL DISCUSSION
ANEMIAS
  DUE TO LOSS OF BLOOD
  DUE TO DEFICIENCIES
    NUTRITIONAL
ANEMIAS (CONT.)
  DUE TO DEFICIENCIES (CONT.)
    PERNICIOUS
  DIET FOR ANEMIAS
DISEASES AFFECTING WHITE BLOOD CELLS

GENERAL DISCUSSION

Since the blood carries the products of digestion to all tissues of the body, distributes oxygen to the cells and removes waste products, its function is vital and any abnormal condition of it immediately interferes with the work of the body as a whole. The blood plasma may under normal conditions have a deficiency or an excess of certain dissolved materials, but that is dependent upon other conditions in the body and will be discussed elsewhere. The red and white corpuscles and the blood platelets are the factors usually affected in diseases of the blood-forming organs. In adult life, the blood is formed and its composition controlled by (1) the bone marrow, (2) the spleen and (3) the lymph glands.

The erythrocytes or red cells in the blood, which normally number about 5,000,000 per cu. mm. in the male and about 4,500,000 per cu. mm. in the female, are short-lived and must be continually renewed to maintain the normal number. A lack of red cells or of the red coloring matter, hemoglobin, which they carry is known as anemia. Just as in other tissue repair in the body, food plays a very important part in supplying the necessary materials for blood building. Unfortunately, however, the dietary treatment of anemias is not so simple as it at first appears, because there are a variety of causes other than food deficiencies which are responsible for anemia; consequently, diet cannot be the only factor concerned in the treatment of these conditions.

ANEMIAS

Anemia may be defined as any clinical syndrome associated with a deficiency in the quantity or the quality of the blood. However, from the point of view of the strictly nutritional aspects, Sherman[1] classifies the anemias into two outstanding types, those due to:

(1) Loss of blood (hemorrhage).

(2) Deficiency of certain substances

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[1] Sherman, H. C.: Chemistry of Food and Nutrition, New York, Macmillan, 1946.

essential to hemoglobin or red-cell formation.

Anemias Due to Loss of Blood

After severe hemorrhage with consequent loss in blood volume, the quantity is first restored to normal by water taken from the tissues. The parching thirst which results is the body's mechanism for demanding an increased intake of water. The dilute blood must then be improved in quality by the production of more red cells and hemoglobin. In an otherwise normal individual recovery is spontaneous, but the red cells are replenished more rapidly than is hemoglobin. The latter will be restored gradually, but the speed of its restoration seems to depend largely upon the diet of the individual. The necessary food materials must be supplied in the diet in order that each of these red cells may contain the normal amount of hemoglobin.

Anemias Due to Deficiencies

This group includes the anemias caused by two types of deficiencies:

(1) Deficiency in substances necessary for hemoglobin formation, such as iron, copper and protein.

(2) Deficiency in substances necessary for red-cell formation and the release of these cells from the bone marrow.

NUTRITIONAL ANEMIAS

Anemias due to lack of iron, copper and protein are sometimes called nutritional or secondary. Hemorrhagic anemias are also called secondary. Nutritional anemias are most often encountered in infancy, in adolescence, in pregnancy and in diseases which interfere with the absorption or the utilization of iron.

In infancy, anemia is usually due to an inadequate prenatal storage of iron and copper. This deficiency may be due to lack of these minerals in the mother's diet, to premature birth or to the birth of twins. In the last instance the maternal supply of iron and copper, ordinarily adequate for one infant, may not be sufficient for two. The quantity of iron stored in the liver of the normal infant at birth is sufficient for blood building even on the low iron diet of milk supplied for the first five or six months, but from then on, and sometimes earlier, some form of iron should be included in the infant's diet. The up-to-date pediatrician pays careful attention to this point. Special emphasis is placed upon iron in the prevention and the treatment of anemia, although copper is also necessary. It rarely happens, however, that a diet that is adequate in iron is lacking in copper.

Chlorosis. A type of anemia known as chlorosis or green sickness is seldom seen today. When it does occur, it is usually in adolescent girls and may be associated with loss of blood in menstruation and with constipation, poor hygiene, gastro-intestinal disturbances and malnutrition, with iron probably the chief deficiency. The reducing fad of the modern girl is undoubtedly responsible for some cases of anemia, as she thus deprives herself of necessary food elements. A mild form of nutritional anemia is far more prevalent among young women than is generally supposed and is bound to interfere with health and vigor.

In pregnancy, a temporary state of anemia may exist owing to deficiency of gastric secretion and withdrawal of body iron for the fetus. Adequate storage of iron in the fetus appears to depend largely on the amount of iron in the mother's diet and the completeness of its absorption. Anemia may be partially prevented at least if care is taken to include a generous supply of the iron-rich foods in the diet.

Dietary Treatment of Hemorrhagic and Nutritional Anemias. It is important to determine the deficiency factor, which may be: (1) Vitamins, as in the anemias of scurvy, pellagra or beriberi; (2) proteins containing all essential amino acids; (3) iron and copper. Deficiency may also result from lack of absorption, as in certain gastro-intestinal diseases. Multiple deficiencies frequently occur simultaneously. But an adequate supply of iron and protein is the important thing to stress in an otherwise well-balanced diet. Whipple and coworkers place liver at the top of the list of foods that promote blood regeneration. Kidney and gizzard are also among the most valuable foods. Certain fruits, such as apricots, peaches, prunes and raisins, also lean meats, are very good sources of material for blood regeneration. Green leafy vegetables, eggs, and cheese are fair sources. Elvehjem and coworkers found that a whole-milk diet supplemented by iron and copper was as effective as liver therapy in the regeneration of hemoglobin. It is therefore essential that the diet should be adequate in all such essentials as protein, minerals and vitamins, and that iron-rich foods such as given above be included daily.

Iron. The type and the amount of iron needed by the anemic patient is usually prescribed by the physician. Food iron may play a part, but at best it can supply little more than 15-20 mg. daily (see Chap. 7). Even though the daily food may have an adequate amount for a normal person, it will probably not have sufficient excess to allow an anemic person to build the required new hemoglobin. Thus we find practical application is now being made of the scientific discovery that soluble iron salts associated with traces of copper can be used for hemoglobin synthesis. Concentrates of such compounds may be given to reinforce the iron supply from food and thus hasten recovery. Iron salts are not easily assimilated by infants, due partially to a deficiency of gastric acid. If nature's method of supplying the fetus with iron through the placenta of the mother has failed, then the best available supplementary form of iron must make good the deficiency in the mother's milk, and this is even more necessary if the child is bottle-fed. Egg yolks, soft-cooked or hard and crumbly, and vegetable broths as additions to the milk supply are good sources of iron for the infant. For further information see Chapter 7.

Protein. Protein has been shown to be of equal importance with iron for blood regeneration. It has been demonstrated that iron with a low protein diet will not allow for blood formation in dogs.[2] It has also been shown by Leverton and March [3] that increasing amounts of protein in the diet have led to increased hemoglobin concentration of the blood. A diet of 75 Gm. of protein is recommended for blood regeneration.[4] The proteins most effective for hemoglobin formation are those of high biologic value included in meat, eggs and milk.

PERNICIOUS ANEMIA

Pernicious anemia differs markedly from the anemias previously discussed in that it is characterized by deficient formation of red cells. As the disease progresses the number of red blood cells decrease, while the size increases. These large cells are called macrocytes. In contrast with the nutritional anemias, pernicious anemia is associated with disorders of the blood-forming organs (bone marrow), the gastro-intestinal tract (deficient gastric secretions) and the central nervous system. Normally the red cells are formed in the red bone marrow and are not released into the blood stream until they reach a so-called mature stage, at which time they contain no nucleus. In pernicious anemia, the cells do not mature normally and they are not released in sufficient numbers from the red bone marrow, which, therefore, becomes overcrowded with these immature cells.

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[2] Hahn, J. F., and G. M. Whipple: J. Exper. Med. **69**:326, 1939.

[3] Leverton, R. M., and A. G. Marsh: J. Nutrition **21**:8, 1941.

[4] Turner, D. F.: J. Am. Dietet. A. **19**:336 1943.

The cause of pernicious anemia is now known to be the lack of a so-called intrinsic factor, a component of the gastric juice. This intrinsic factor combines with the extrinsic factor, a component of the protein of food to form an antianemic factor which is stored in the liver until it is needed by the bone marrow for the formation of red cells. While the chemical composition of the substances is still unknown, it has been shown that liver and liver extract in particular are very effective as a remedial agent due to the antianemic principle stored in the liver. Recently two additional products have been discovered which are believed to be of great potency in the treatment of pernicious anemia: one is synthetic folic acid, a fraction of the vitamin B complex; the other is an extract made from the thymus gland and is therefore called thymin (not thiamine). The folic acid is said to be one thousand times more effective than the thymin, measured quantitatively. It is especially useful when there is an allergy to liver.

Dietary treatment of the primary or pernicious anemias is characterized by:

(1) The administration of liver or liver extract.

(2) A diet rich in iron and easily digestible.

(3) An abundance of all vitamins.

(4) Calories adjusted to patient's needs.

(5) The avoidance of indigestible foods (fried or rich in fats) because of the lowered digestive ability.

Marked progress has been made in the dietetic treatment of pernicious anemia since Minot and Murphy first introduced the idea of liver therapy. Large quantities of cooked and raw liver were originally fed to patients afflicted with pernicious anemia. This distasteful regimen has been replaced largely by the use of extracts which are sometimes given intravenously or intramuscularly.

During the first few days of treatment there is a marked increase in the number of immature red cells in the blood. These cells are called reticulocytes, because when they can be stained the nucleus appears as a mesh or network. After a few days this nucleus disappears and the cells appear as normal erythrocytes. The cell count and hemoglobin continue to increase until the normal levels are reached, and they may be maintained as long as some type of liver or similar therapy is continued. Appetite and digestion also improve, and may be improved further by the use of dilute hydrochloric acid with meals.

The diet should be well balanced, as for normal nutrition, with the addition of liver or liver extract. Some physicians have found that a high vitamin intake has increased the rate of recovery and reduced the amount of liver extract necessary, especially when generous amounts of Brewer's yeast have been given. Extremely potent fractions of liver extract have recently been prepared and can be used in much smaller quantities than formerly. When these extracts are injected directly into the blood stream or intramuscularly, one injection suffices for 3 or 4 weeks.

Diet for Anemias

Pernicious Anemia. A normal or a general house diet is modified by substituting for the meat from ¾ to 1 lb. of liver daily unless liver extract is being given. Foods high in iron should be stressed. They may be selected from the list below. Liberal amounts of green vegetables and fresh fruits are advised.

Secondary Anemia. Foods rich in iron should be selected. The general diet is supplemented by ¼ lb. of liver and two hard-cooked egg yolks daily. Leafy vegetables should figure prominently in the diet. Whole-grain cereals and breads should be given these patients. If patients require more iron than is obtained on this diet, foods may be selected from the preceding list.

IRON VALUES PER SERVING

	Weight	Iron mg.
Liver, beef	100	8.3
calf	100	5.4
Tongue, beef	100	6.0
Heart, beef	100	6.2
Kidney, beef	100	4.0
Beef, lean	100	4.1
Pheasant	100	3.7
Turkey, dark	100	5.9
Chicken, lean	100	4.1
Oysters	100	7.1
Clams	100	4.4
Egg yolks (3)	50	3.6
Lima beans, dried	50	3.8
fresh	100	2.3
Navy beans	50	5.1
Molasses	50	3.8
Apricots, dried	50	2.5
Peaches, dried	50	3.5
Prunes, dried	50	2.0
Raisins	50	2.8
Mustard greens, fresh	100	2.9
Beet greens, fresh	100	3.2
Bran flakes	25	2.4
Whole-wheat bread (2 slices)	60	1.5

During World War II civilians were urged to give blood to be used as transfusions for the wounded men overseas. Many people gave repeatedly. It was therefore desirable for them to eat foods selected with special reference to hemoglobin regeneration.

The following recommendations for blood donors were prepared by a committee of the American Dietetic Association.[5] They are of course equally beneficial for all types of nutritional anemias.

DIET FOR NUTRITIONAL ANEMIAS

Meat, Poultry, Fish or Soybeans: Approximately 4 ounces. Liver or kidney should be included in the diet two or more times per week. Lamb, beef, calf or pork liver may be used. Liver should be cooked only until it is no longer red. Beyond that point it becomes tough. Heart and tripe are also good blood builders. Pork or ham once a week will augment the thiamin intake. Other meats, poultry and fish may be used. Oysters are of especial value. Soybeans have been found to contain proteins of good quality and quantity. One half cup cooked soybeans is equivalent to approximately 2 ounces of edible meat

Eggs: One or more daily. Eggs may be used alone or combined with other foods. Soybeans may be used as a substitute for eggs in the following proportions: ½ cup cooked soybeans is equivalent to 2 eggs

Milk: 1 pint or more daily. It may be used for cooking and for drinking. 1 ounce American cheese may be considered approximately equal to 1 glass milk (7 ounces) in calcium, phosphorus, iron and protein. However, the thiamin and the riboflavin values will be considerably less in the cheese portion

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[5] Turner, Dorothea F.: J.A.D.A. **19**:336, 1943.

Legumes: 2 servings or more per week of soybeans, dried peas, beans, lentils or peanut butter

Fruits: 2 servings or more daily, one of which should be a large serving of citrus fruit or tomato, either fresh or canned. Apricots, peaches and prunes have been found to be effective blood builders and may be used as the second fruit

Vegetables: 2 servings or more daily, one of them leafy, green or yellow. In addition, one serving or more of either white or sweet potato daily. In cooking vegetables as little water as possible should be used, and they should be cooked for only a short period of time. The water in which the vegetables are cooked should be saved and used in soups, gravies and vegetable cocktails

Cereals and Breads: Whole-grain and enriched cereals and whole-grain or enriched white bread should be used daily. These foods may be used in amounts necessary to meet caloric requirements

Fats and Sweets: These foods may be used in addition to the protective foods listed above, but not as a substitute for any of them. Large amounts of fats or sweets should be avoided, however; too much will affect the appetite and may cause an undesirable gain in weight

DISEASES AFFECTING THE WHITE BLOOD CELLS

Leukemia and Agranulocytosis. While diseases of the red blood corpuscles, anemias, are much more common than those affecting the white blood corpuscles or leukocytes, there are two diseases of the white blood cells which cannot be overlooked: leukemia is a disease characterized by an abnormally great production of leukocytes; agranulocytosis, by a diminished production of leukocytes.

There is some evidence that folic acid may be effective in the regeneration of the white blood cells, as well as in the treatment of the anemias.

As yet no specific dietary treatment for agranulocytosis has been determined. Although there is no known cure for leukemia, it is desirable that the red cell count and the hemoglobin be kept at high levels. A high caloric diet, with additional iron, liver or liver preparations, has been recommended.

REVIEW QUESTIONS

1. What are the causes of secondary anemias? Of pernicious anemia?
2. What factors should be considered in planning a diet for a patient with nutritional anemia?
3. What is the normal iron requirement for an adult woman? When is this requirement increased? Why? Why do men require less?
4. What foods supply the largest amount of iron? What is about the largest amount of iron that can be supplied per day from foods?
5. Plan a diet that will supply 12 mgms. of iron.

32

Diseases of the Musculoskeletal and the Nervous Systems

Chapter Topics

DISEASES OF THE MUSCULOSKELETAL SYSTEM
ARTHRITIS
LEAD POISONING

DISEASES OF THE NERVOUS SYSTEM
EPILEPSY
MIGRAINE
MÉNIÈRE'S SYNDROME

DISEASES OF THE MUSCULOSKELETAL SYSTEM

ARTHRITIS

While there are other types of musculoskeletal diseases, the principal one is arthritis.

Acute arthritis is any acute inflammatory process which involves the joints. Like other acute infections, an attack is of short duration but it may recur and in time become chronic. As an acute condition, it should receive much the same treatment as other acute illnesses. The diet should be planned according to the general condition of the patient. If accompanied by fever, as in so-called rheumatic fever, the same general directions for fevers and infections (see Chap. 21) should be followed. If accompanied by anemia, the directions for that condition (see Chap. 31) should be followed.

Chronic arthritis is usually classified as (1) rheumatoid, infectious or atrophic and (2) osteo-arthritis, static or hypertrophic.

Rheumatoid arthritis occurs more frequently than the hypertrophic form, and usually starts in early adult life. Women are much more susceptible to it than men. This type is often called chronic infectious because infections are the common cause of the ailment. There may be many predisposing causes which reduce resistance to infection.

DIETARY TREATMENT

Physicians for some years have recognized that focal infections of tonsils, sinuses, teeth, the colon or the genitourinary tract may be causative factors. Many cases occur, however, when no such foci of infection are apparent. Pemberton, who had an opportunity to observe a large number of cases in army hospitals during World War I, believed there were other contributing causes such as exposure and injury. He made careful studies of the blood chemistry of his cases and found in most of them an increased blood sugar. He therefore limited the carbohydrate in the diet, substituting fats, and at the same time lowered the caloric intake to about that of the basal requirements. He reported marked improvement in many of his cases. It was therefore believed by many that the cause of arthritis—a disturbed carbohydrate metabolism—had been found.

Later, Fletcher of Toronto contributed another chapter to the carbohydrate story. He also limited carbohydrate intake, because recent work had shown that carbohydrate increased the demand for thiamine. In addition, he gave wheat germ or yeast to increase the supply of thiamine.

B-complex rather than carbohydrate deficiency has been shown by Spackman[1] to be almost always a part of the clinical picture in arthritis.

Low-grade edema is also a common finding in arthritis and many of the benefits of various regimens advocated have the common purpose of elimination of tissue fluid.

Although nutrition constitutes but one of the many factors involved in arthritis, there is evidence that diet can play a part in the treatment by supplying optimal nutrition, since faulty nutrition may be responsible for some of the symptoms attributed to arthritis.

The caloric allowance should be adjusted to the condition of the patient: if underweight and malnourished, as many are, a high caloric, high-vitamin diet is indicated. If the patient is overweight, a low caloric diet is usually recommended as a means of relieving pressure on the involved joints.

The protein should meet the standard requirement for the individual. Fruits and vegetables should constitute an important part of the diet. The selection of foods should be such as to afford optimal intake of minerals and vitamins, especially vitamins A and D and the B complex.

Since patients frequently suffer from an atonic form of constipation, which some now believe is due to a vitamin deficiency—vitamins B_1, C, and D—wheat germ, yeast, fish-liver oil, fresh fruit and vegetables are included in the dietary regimen. The regimen prescribed for constipation (see Chap. 26) is recommended here.

Osteo-arthritis usually occurs in persons beyond middle life and, like rheumatoid arthritis, is found more frequently in women than in men. These cases often present a healthy appearance, although they are usually overweight and have bad posture. Constipation and arteriosclerosis are frequent complications. It is therefore thought to be a natural accompaniment of old age. It is known that overweight puts a strain upon the weight-bearing joints, such as ankles and knees, hence it is important that the dietary treatment should be directed toward attaining a normal weight (see Chap. 20).

Gout may produce a condition resembling arthritis which results sometimes in a permanent deformity or a crippling of the joints. For further information see Chapter 33.

LEAD POISONING

Lead may enter the body through the gastro-intestinal tract when mixed with food or drink; through the skin when cosmetics and hair dyes are used; and through the respiratory system when lead dust is inhaled. Exposure to powdered lead in the manufacture of paint, rubber and other products constitutes one of the greatest industrial hazards. Absorption through the skin is usually negligible.

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[1] Spackman: Am. J. M. Sc. **202**:68, 1941.

That which enters the gastro-intestinal tract is less dangerous than that which enters through the respiratory tract, as it is more easily removed. Most of the lead which enters the blood stream is finally stored in the bones, where it is harmless. It is only when it is liberated that it produces toxic effects. When large quantities are liberated in a short period of time, as after a drunken debauch or severe illness, the symptoms of toxicity, such as vomiting, colic, weakness and collapse, may be acute.

DIETARY TREATMENT

During the acute stage, the remedy consists of injections of calcium chloride solution and a diet high in calcium consisting chiefly of 1 to 2 quarts of milk. The lead is liberated only when there is a negative calcium balance, hence the giving of calcium prevents further withdrawal and the acute symptoms disappear. When the acute stage has passed, the treatment is reversed and a low calcium diet is given to permit of a gradual withdrawal of lead from the bones. Therefore foods rich in calcium are omitted from the diet. For a list of these foods see Chapter 7.

Anemia is a common symptom and is treated in the same way as any other secondary anemia with a diet high in iron-rich foods.

DISEASES OF THE NERVOUS SYSTEM

Although there are numerous diseases of the nervous system, not much importance has been attached to the diet as a causative factor. It is true, however, that much greater effort is now being made to supply a thoroughly adequate and palatable diet for those in hospitals, and those in institutions with mental and nervous diseases.

Some research as to dietary factors has recently been reported by Miller[2] of St. Elizabeths Hospital, Washington, D. C. Observations were made on 20 patients, all suffering from insomnia, anxiety, nervous tension and emotional lability. They were placed on a restricted salt regimen of 2 Gm. of sodium chloride per day. It was found that a satisfactory level of chloride excretion was attained after 7 to 15 days, when the sodium chloride could be increased to 3 to 4 Gm. daily.

The usual results of the restricted salt regimen were (1) pronounced or moderate relief from tension and insomnia and (2) lowered blood pressure and pulse rate. Miller therefore recommends a low sodium chloride diet (known also as a low sodium diet, see Chap. 29) as an important adjunct to psychotherapeutic measures in the treatment of insomnia and tension states. (See also Table 5, Part Four.)

Epilepsy, migraine and Ménière's syndrome are discussed in more detail below.

EPILEPSY

Epilepsy is a disorder which has afflicted mankind for many centuries. Hippocrates and other ancient writers described it in their writings, some believing that it was caused by evil spirits. It is characterized by convulsive attacks accompanied by unconsciousness. McLester[3] describes it as a "manifestation of a variety of lesions of the central nervous system, the most important of which is cerebral trauma acquired at birth or later.

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[2] Miller, M. M.: J.A.M.A. 129:262, 1945.

[3] McLester, J. S.: Nutrition and Diet in Health and Disease, Philadelphia, Saunders, 1943.

Heredity plays a part but probably only to the extent of providing the patient with nerve structures which are more sensitive to irritation than are those of other persons."

It is a disease of childhood and adolescence usually, but may persist into adult life.

TREATMENT

Various therapies have been tried in the treatment of this condition. At the present time such drugs as phenobarbital, dilantin, sodium and bromides are believed to be the most effective means of controlling the seizures. This method of treatment has in most instances replaced other types of therapy.

Until recently the ketogenic diet was used widely in the treatment of epilepsy, especially for young children. With the advent of effective drug therapy the main use of the diet is for those cases which do not tolerate drugs well.

The ketogenic diet is very low in carbohydrate, very high in fat with adequate protein and caloric intake for the individual patient. The ratio of carbohydrate to fat in grams is usually 1:3 to 1:4. Such a diet will produce a state of acidosis, which, if maintained continuously, is effective in reducing the convulsions. The ketogenic diet is difficult to follow, since the high fat, low carbohydrate intake does not lend much variety and the large amounts of fat are often distasteful. It is an expensive diet as well and calls for fortitude and real co-operation on the part of the patient if it is to be effective.

The majority of epileptic patients, therefore, along with the drug therapy of choice, are advised to eat a diet that will supply them with all the requirements of normal nutrition for their age and activity. They may be advised to restrict the fluid intake somewhat since dehydration is thought by some to be helpful in controlling seizures. Alcoholic beverages, which are known to be a causative factor, are prohibited. Other than that there need be no modification of the food requirements.

In the event that a ketogenic diet is recommended, the following outline gives the characteristics of the diet and will illustrate the method of calculating it.

Ketogenic Diet

Characteristics:

1. It is usually a weighed diet
2. It is calculated for each individual
3. It is adequate or high protein
4. It is adequate in calories to maintain weight in adults and growth in children
5. It has a high ratio of fatty acid to glucose which varies with the ease with which ketosis is attained and the intensity of the ketosis desired
6. There is a gradual lowering of the carbohydrate to prevent acidosis

Foods Used Freely:

Fats—40% cream, butter, salad oils, bacon, bacon fat, chicken fat
Vegetables—3% carbohydrate
Meats, fish, poultry—All
Eggs and cheese

Foods Allowed in Limited Amounts:

Bread substitutes—Soybean preparations and gluten preparations of low starch content
Vegetables—6% carbohydrate
Fruits—3%, 6% and 9% carbohydrate
Milk—(if allowed)

Supplements:

Brewer's yeast, wheat germ, calcium lactate. Saccharine may be substituted for sugar

Foods to Be Avoided:

Sweets—Sugar, candy, chewing gum, honey, jelly, jams, preserves, sweetened fruit
Desserts—Pastries, pies, cakes, cookies, ice cream and all sweetened desserts
Cereals—All
Breads—All except soybean and certain gluten preparations
Vegetables—9% and higher
Fruits—12% and higher, dried
Beverages—In limited amounts

TYPICAL MENU

(Carbohydrate 40 Gm.; Protein 80 Gm.; Fat 300 Gm.)

BREAKFAST

2 Eggs
1 Soybean flour muffin
30 Gm. butter
50 Gm. cream
50 Gm. grapefruit (edible portion)
Coffee or tea

DINNER

125 Gm. roast beef
100 Gm. tomato and lettuce
25 Gm. salad oil
50 Gm. peas
35 Gm. butter
2 Soybean flour muffins
75 Gm. cream
75 Gm. pear (water-packed)
Coffee or tea

SUPPER

50 Gm. American cheese
50 Gm. head lettuce
25 Gm. spinach
50 Gm. carrots
35 Gm. butter
75 Gm. cream
75 Gm. cherries (water-packed)
Coffee or tea

KETOGENIC DIET FOR A CHILD 7-9 YEARS OF AGE

(2,000 Calories; 60 Gm. Protein)

Food	Calculation (*Protein* 60 Gm.; *Carbohydrate* 20 Gm.; *Fat* 187 Gm.)			
	Amount Gm.	Protein	Fat	Carbohydrate
Breakfast				
Fruit, 6%	50	1		3
Cream, 40%	100	2	35	3
Butter	5		4	
Eggs (2)	100	13	11	
Bacon	20	2	11	
Dinner				
Roast beef (med. fat)	120	19	25	
Vegetable, 3%	100	2		3
Fruit, 6%	50	1		3
Cream, 40%	50	1	18	1
Butter	25		20	
Supper				
American cheese	60	16	20	1
Vegetable, 3%	100	2		3
Cream, 40%	100	2	35	3
Butter	10		8	
Total		61	187	20

Migraine

Emerson [4] states that idiopathic migraine is "a purely functional nervous syndrome which in the great majority of cases would seem to develop against a background of perfect health." He states further that it is a common ailment which usually begins before 20 years of age. The attacks are periodic, or may occur at irregular intervals. They are preceded by an aura or signal symptom and usually last from 1 to 3 days. The chief symptom is an agonizing headache, usually unilateral, at least in the beginning of the attack, but it may become general. Nausea, vomiting and sometimes abdominal pains are also characteristic symptoms.

While the etiology is unknown, it has been noted that migraine runs in families, and that a close relationship seems to exist between it and epilepsy. It has been found that in some cases at least, a state of alkalosis develops prior to the attack. Some cases have been traced to allergic reactions.

TREATMENT

The patient should eat and sleep regularly, should avoid overeating and excessive water drinking, and should also avoid constipation.

Cases that are known to be of allergic origin should be treated accordingly (see Chap. 28).

Ménière's Syndrome

Ménière's syndrome comprises a group of symptoms which include dizziness and gastro-intestinal disturbances associated with unilateral defects in hearing and in equilibrium. This syndrome is thought to be due to a swelling of the vestibular apparatus of the ear caused by an allergic response or by a spasm of the blood vessels within the ear. It has also been attributed to sodium retention.

TREATMENT

Dietary treatment is based on abstinence from foods to which the patient is sensitive or a salt-poor acid-ash diet and ammonium chloride as advocated by Furstenberg.[5] Some cases respond also to vitamin therapy. Atkinson [6] advises a high protein, high vitamin diet with the addition of niacin in the acid form, largely for its effect as a vasodilator. For elderly people he advises another factor of the B complex, thiamine, as it is milder in its effects on the blood vessels. Because Ménière's syndrome or disease is a vasospastic condition, he also states that smoking should be forbidden.

REVIEW QUESTIONS

1. What are some of the factors said to cause rheumatoid arthritis?
2. What is the generally accepted dietary treatment of rheumatoid arthritis? Osteo-arthritis?
3. What is the principle of using a low calcium diet for the treatment of lead poisoning? What foods should be avoided?
4. What is the accepted treatment for epilepsy at the present time? What role should diet play in its treatment? What is the ketogenic diet? When may it be used?
5. What part can diet therapy play in the treatment of migraine?
6. What type of diet has been advocated in treating Ménière's syndrome? Why?

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[4] Emerson, C. P.: A Textbook of Medicine, Philadelphia, Lippincott, 1946.

[5] Furstenberg, A. C., *et al.:* Ann. Otol., Rhin. & Laryng. **43**:1035, 1934.

[6] Atkinson, M.: J.A.M.A. **116**:1753, 1941.

33

Miscellaneous Metabolic Disturbances

Chapter Topics

SPONTANEOUS HYPOGLYCEMIA	ADDISON'S DISEASE
HYPERTHYROIDISM	GOUT
HYPOTHYROIDISM	TETANY

SPONTANEOUS HYPOGLYCEMIA

Etiology. Spontaneous hypoglycemia is not a clinical entity in itself but a disturbance of the carbohydrate metabolism which may be caused by a number of seemingly unrelated factors involving the liver, the pancreas and other organs of the endocrine system, as well as the nervous system. One of the chief causes, however, is known to be hyperinsulinism, which is a metabolic disturbance in which the pancreas is involved. Its effects are the opposite of those seen in diabetes mellitus. Another main cause is a tumor of the pancreas.

Symptoms. The symptoms are almost identical to those produced by overdoses of insulin in the treatment of diabetes mellitus.

Hypoglycemia, or low blood sugar, is accompanied by attacks of weakness, trembling and sweating which occur before breakfast and 1 to 2 hours before the midday and the evening meals, also before retiring and frequently during the night. In severe cases there may be unconsciousness, convulsions and hysterical symptoms. This disease is characterized by extreme hunger—indeed, it is often known as the hunger disease. Abdominal discomfort, which is also characteristic, is relieved by taking food and, because of this similarity to peptic ulcer, it is sometimes mistaken for that condition.

Dietary Treatment

A carefully planned and regulated dietary regimen is quite as important in hyperinsulinism as in diabetes mellitus, where hypoinsulinism is the causative factor. Since the objective of treatment is to supply the body with sources of glucose in as continuous a flow as possible, the slower acting nutrients, protein and fats seem to be the most effective. For this reason Conn[1] and others[2] recommend a high protein (120 to 140 Gm.), low carbohydrate diet (50 to 75 Gm.) with liberal amounts of fat (175 Gm. or more) sufficient to make up the calories. The basis for restriction of the carbohydrate is the fact that carbohydrate stimulates the islet cells to further insulin production.

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[1] Conn, J. W.: J. Clin. Investigation 5:673, 1936; J.A.M.A. **115**:1669, 1940.

[2] Beeuwkes, A. M.: J. Am. Dietet. A. 18:731, 1942.

The patient's nutritional needs should be calculated in each case. The adult patient with hyperinsulinism, of average height and weight, should have about 2,250 calories. The food intake is best divided into 5 to 8 feedings a day.

HYPERTHYROIDISM

Etiology. Hyperthyroidism, as the name would indicate, is a condition characterized by an excessive secretion of the thyroid gland. It is known also as thyrotoxicosis, exophthalmic goiter, Graves' disease or Basedow's disease. The chief symptoms are bulging eyes, nervous irritability, fatigue, weakness, rapid pulse, loss of weight and a high metabolic rate. The high metabolic rate, of course, accounts for the loss of weight, for it will be remembered that the thyroid gland through its internal secretion is probably the chief regulator of energy metabolism. The rate of metabolism is increased from 15 per cent above normal in mild cases to 75 per cent or more in severe cases. When the metabolic rate is excessive, not only are the nutrients in the body burned too rapidly, but the tissues even are drawn upon as a source of additional fuel.

Treatment. It is important therefore that additional food should be supplied and that the patient should rest to prevent unnecessary expenditure of energy. When the metabolic rate is excessive, it may be necessary to increase the food supply to from 4,000 to 5,000 calories. The high caloric diet (see Chap. 20) as modified herewith is therefore indicated.

Since protein is known to stimulate metabolism to some extent (see Chap. 5), it is deemed wise to restrict it to a normal intake. Milk, however, should be taken in generous amounts, not only for its protein and caloric values but for its calcium. Indeed, it is believed wise to increase both calcium and phosphorus, also the vitamin content of the diet, especially thiamine, the store of which is believed to be exhausted quickly because of the increased metabolism. All stimulants such as coffee, tea, alcohol and tobacco are prohibited.

HYPOTHYROIDISM

Hypothyroidism is marked by a deficient secretion of the thyroid gland. It is also known in its advanced stage as myxedema. It is characterized by a low metabolic rate, ranging from minus 15 per cent to minus 30 per cent or more, and may be said to be the antithesis of hyperthyroidism. These patients usually have good appetites and gain weight rapidly. The treatment for this condition consists of medication in the form of desiccated thyroid and the regulation of the diet, which should be a low caloric diet such as is described in Chapter 20.

ADDISON'S DISEASE

Etiology and Symptoms. Addison's disease is rare and the prognosis grave, although newer methods of treatment make the possibilities of control more hopeful. It is characterized by a bronze discoloration of the skin, severe prostration, progressive anemia, low blood pressure, dehydration, nausea, diarrhea and digestive disturbances. The disease is due to impairment or destruction of the cortex of the suprarenal (adrenal) glands, caused chiefly by tuberculosis and atrophy. The suprarenal cortex is believed in some way to control water metabolism and the water distribution in the body, the metabolism and the excretion of sodium and potassium and carbohydrate metabolism.

Loeb [3] has demonstrated that the sodium content of the blood of patients suffering from Addison's disease is greatly decreased. Adrenalectomized dogs or cats show similar symptoms, owing to loss of sodium through the kidneys, and life has been prolonged in such animals by the injection of salt solutions. The administration of NaCl in typical cases of Addison's disease is reported by Loeb to have been followed by relief from the more distressing symptoms and marked decrease in exhaustion. It is believed that the NaCl furnished the necessary sodium to replace the excessive loss from the blood and tissues with equivalent loss of fluid. Potassium is found in the blood in abnormally large amounts. Cortical extract prepared from the suprarenal glands controls the disease if administration is continued indefinitely. Desoxycorticosterone acetate, a synthetic hormone, has also been found to be effective.

Treatment. With the production of cortical extracts and desoxycorticosterone acetate the therapy of Addison's disease has become much easier. Where formerly a low potassium diet, which is difficult of preparation, was used, the treatment now consists of administration of either the cortical extract or desoxycorticosterone acetate, sufficient amounts of sodium chloride, water and an adequate diet.

The cortical extracts are given intramuscularly. The desoxycorticosterone may be administered in the same way or by pellets implanted under the skin. The latter are not as expensive as the extracts and they are now used when obtainable in preference to the extracts.

Salt therapy [4] must be combined with the cortical extract. The diet should contain more sodium chloride than that usually used in the preparation of the food. In addition, tablets or capsules containing salt may be given along with the meals. The salt has a sparing action on the hormonal needs and thus decreases the expense of the treatment.

The diet should meet all the requirements of adequate nutrition. Since there is a tendency to hypoglycemia in Addison's disease, it is advisable to have the diet high in carbohydrate (7 to 8 Gm. per kilo). It should be served in frequent feedings and include a late evening nourishment.

The protein should be at least normal, and it is recommended by some that an allowance of 1½ to 2 Gm. per kilo be given. This is especially important if the patient, because of digestive disturbances, can tolerate fats only in limited amounts.

The very low intake of potassium which was recommended a few years ago is now no longer necessary with the hormonal and salt therapy. If, however, foods of low potassium content are prescribed, see Ashkins *et al.*[5] The appetite of the patient with Addison's disease is fickle, and with the accompanying gastro-intestinal disturbances it requires much catering to the desires of the patient in order to maintain sufficient food intake. Attractive palatable meals are extremely important.

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[3] Loeb, R. F., and D. W. Atchley: M. Clin. North America **17**:1317-23, 1934; P.S.E.B. & M., **30**:808, 1933. Loeb, R. F.: Bull. N. Y. Acad. Med. **16**:347, 1940, and **18**:263, 1942.

[4] Rowntree, L. G.: Cecil's Textbook of Medicine, Philadelphia, Saunders, 1947.

[5] Ashkins, V., and R. L. Zwemer: J. Am. Dietet. A. **14**:181, 1938.

GOUT

Etiology and Symptoms. Gout is another metabolic disorder closely related to arthritis. It is characterized by acute attacks of so-called gouty arthritis which usually last for several days, during which time certain joints become swollen and inflamed, especially that of the great toe. Tophi (see Figs. 74 and 75) are also likely to appear. Pain of course accompanies these attacks, which after a limited time may disappear entirely until another attack recurs.

The cause of this disease is not definitely known, although it is generally conceded to be a disturbance of the purine metabolism, the purines being formed in the breakdown of certain kinds of protein, chiefly those of animal origin. The purines may be produced within the muscular tissues of the body or they may enter the body through foods in which they normally occur. Uric acid is the end product of purine metabolism. It is found in the blood and the tissues, as it accumulates in much the same way that glucose does in diabetes, although in gout there may be actual deposits of sodium urate, a compound of uric acid, in and about the joints.

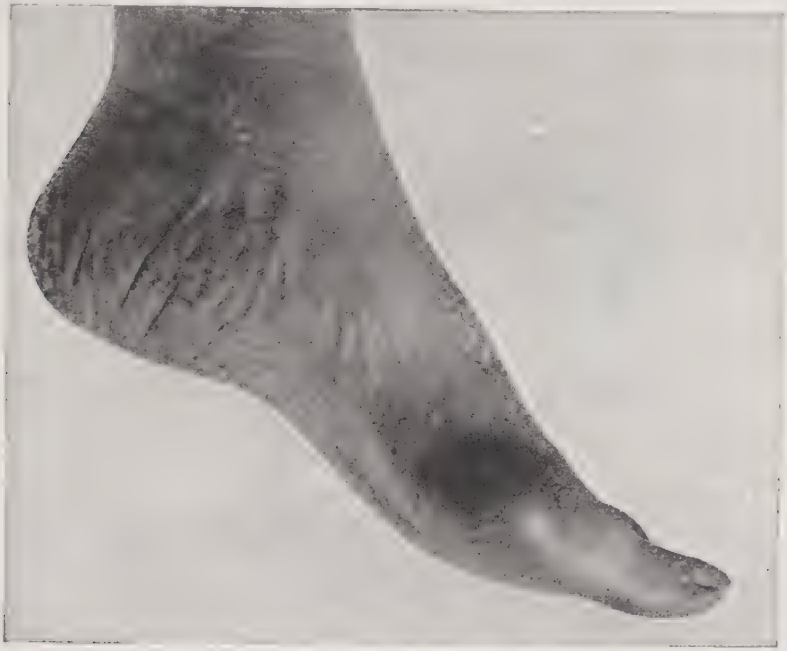

Fig. 74. Acute gouty arthritis of great toe. (Cecil, Textbook of Medicine, ed. 7, Philadelphia, Saunders.)

During the attacks of acute pain the uric acid of the urine is usually increased, although at other times the uric acid of the blood only is increased. Deficient elimination is a contributing factor; hence the free use of water, both internally and externally, is recommended. Mineral waters are often used. Hot baths also increase the elimination and decrease the pain.

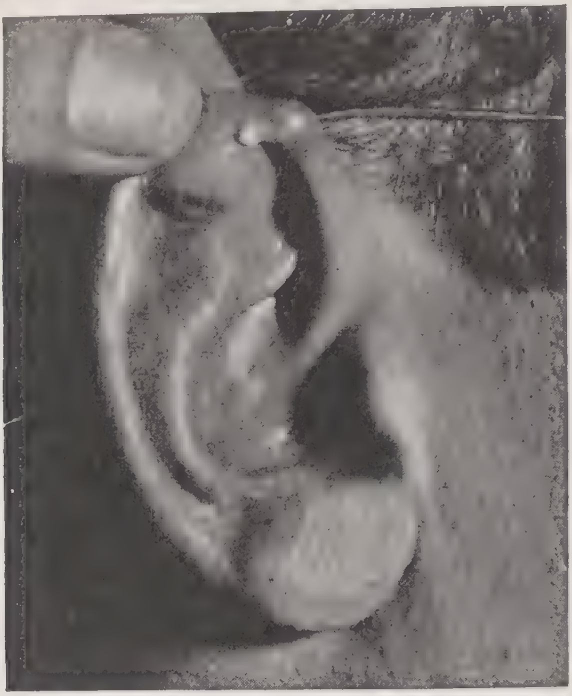

Fig. 75. Two tophi on ear. (Cecil, Textbook of Medicine, ed. 7, Philadelphia, Saunders.)

Dietary Treatment

The diet is the chief remedial measure. As gouty patients are usually overweight, it is of prime importance that the diet be made low in calories until normal weight is attained. Since purine metabolism is disturbed, it is obvious that foods rich in these substances should be used sparingly. Meats of all kinds contain purines, but sweetbreads and other glandular organs such as liver contain large quantities.

The chart entitled Purine Content of Certain Foods classifies the principal foods into four groups according to purine content. The foods in List 1 contain very large amounts, while those in List 4 contain an insignificant amount of purine or no purine. It is apparent therefore that List 4 contains the foods of choice for a low purine diet.

The diet to be prescribed will depend upon the condition of the patient at the time he is seen by the physician. If the patient is having an acute attack of gouty arthritis, as described above, a purine-free or at least a low purine diet will undoubtedly be prescribed. Eggs, milk and cheese will be the chief sources of proteins. The diet is also usually low in fat, as fat is thought to prevent the normal excretion of urates (salts of uric acid), which may form deposits called tophi about ears, toes, fingers and other joints. Recent tests have shown that high fat and low carbohydrate diets may precipitate an attack in gouty patients. Since the diet is low in fat and restricted to dairy products, the caloric value can only be maintained by including foods of high carbohydrate value. If, however, the patient is obese, a low caloric diet is indicated. The diet must also consist of foods that are easily digested and prepared without seasonings, except salt. Tea, coffee, chocolate and condiments are sometimes prohibited, but Hench[6] states that "coffee and tea are permissible, being methylated purines which do not form uric acid." He also states that "complete abstinence from alcohol is advisable."

Recovery from the acute gouty attacks may occur within a few days or longer. But the patient should be made to understand that he is not "cured," since gout is a chronic disease, and that a recurrence is likely unless his diet is carefully controlled.

Interval Diet. Hench[7] summarizes the interval treatment as related to the diet as follows:

"Each patient must be treated individually as the stage and severity of his disease and his temperament dictate. In general, the diet should be free of purines on two, not necessarily consecutive, days and low in purines five days a week. Normal diets contain 600 to 1,000 mg. of purines daily; a low purine diet contains 100 to 150 mg., and can be attained roughly by allowing one food from List 2 one day a week, and one from List 3 four days a week, besides whatever foods are desired from List 4. Normal weight should be maintained and obesity avoided. Two days weekly the selections should be only from List 4. Foods in List 1 should always be avoided entirely, also spices, condiments and rich or indigestible foods and sauces. Deficiencies in protein, iron and vitamin B_1 must be avoided. Generally, the diet should be reinforced with an approved preparation of the vitamin B complex."

PURINE CONTENT OF CERTAIN FOODS[8]

LIST 1

Foods which contain very large amounts (150 to 1,000 mg.) of purine bodies in 100 Gm.:

Sweetbreads	825 mg.
Anchovies	363 mg.
Sardines (in oil)	295 mg.
Liver (calf, beef)	233 mg.
Kidneys (beef)	200 mg.
Brains	195 mg.
Meat extracts	160-400 mg.
Gravies	variable

LIST 2

Foods which contain a large amount (75 to 150 mg.) of purine bodies in 100 Gm.:

Bacon
Beef
Calf tongue
Carp
Chicken soup
Codfish
Duck
Goose
Halibut
Lentils
Liver sausage
Meat soups
Partridge
Perch
Pheasant
Pigeon
Pike
Plaice
Pork
Quail
Rabbit
Sheep
Shellfish
Squab
Trout
Turkey
Veal
Venison

LIST 3

Foods which contain a moderate amount (up to 75 mg.) of purine bodies in 100 Gm.:

Asparagus
Bluefish
Bouillon
Cauliflower
Chicken
Crab
Eel
Finnan haddie
Ham
Herring
Kidney beans
Lima beans
Lobster
Mushrooms
Mutton
Navy beans
Oatmeal
Oysters
Peas
Salmon
Shad
Spinach
Tripe
Tuna fish
White fish

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[6] Hench, Philip S.: Cecil's Textbook of Medicine, Philadelphia, Saunders, 1947.

[7] *Ibid.*

[8] Hench, P. S.: J.A.M.A. **116**:453, 1941.

All whole-grain bread and breadstuffs, and all whole-grain cereals, including wheat germ and bran.

List 4

Foods which contain an insignificant amount of purine or no purine:

Beverages:
- Carbonated
- Chocolate
- Cocoa
- Coffee
- Fruit juices
- Postum
- Tea

Butter *
Breads—White bread and crackers, corn bread
Caviar

Cereals and cereal products:
- Corn
- Rice
- Tapioca
- Refined wheat
- Macaroni
- Noodles, etc. . . .

Cheese of all kinds *
Eggs
Fats of all kinds (but in moderation)
Fruits of all kinds
Gelatin
Milk, buttermilk, evaporated, condensed, malted milk
Nuts of all kinds *
  Peanut butter *
Pies * (except mince-meat)
Shad roe
Sugar and sweets

Vegetables:
- Artichokes
- Beets
- Beet greens
- Broccoli
- Brussels sprouts
- Cabbage
- Carrots
- Celery
- Corn
- Cucumber
- Dandelion greens
- Eggplant
- Endive
- Kohlrabi
- Lettuce
- Okra
- Parsnips
- Potato
  - sweet
  - white
- Pumpkin
- Rutabagas
- Sauerkraut
- String beans
- Summer squash
- Swiss chard
- Tomato
- Turnips

* These foods are high in fat.

NOTE: To calculate the purines or purine bodies in a given food the purine nitrogen is multiplied by 3. Example: 200 mg. of purine nitrogen equal 600 mg. of purine bodies.

TETANY

Etiology. Tetany, otherwise known as spasmophilia, is a term applied to a disturbance of muscular function characterized by convulsions or other muscular spasms. It occurs much more frequently in children than in adults, although it is not uncommon in pregnancy. The cause is sometimes due to hypoparathyroidism. It frequently occurs when some of the parathyroid glands have been removed by thyroidectomy, although there may be other causes, the exact nature of which is not always known. It is associated with disturbances of mineral metabolism characterized usually by one of two abnormalities:

1. Hypocalcemia (low blood calcium)
2. Alkalosis

Hypocalcemia may be due not only to an endocrine disturbance but to a deficiency of the food intake or to a loss of calcium, such as occurs in pregnancy, in osteomalacia and in fatty diarrhea. The food deficiency may be due to lack of calcium in the diet or to a nonutilization of it, caused by vitamin D deficiency. The treatment, therefore, consists of such measures as will increase the utilization of calcium, such as exposure to sunlight or ultraviolet light and the administration of vitamin D in the form of viosterol or certain fish-liver oils. Calcium salts are also administered to increase the blood supply.

Dietary Treatment

A diet high in calcium and in vitamin D augments the above measures. In the following table will be found lists of foods that are (1) high in calcium and (2) high in vitamin D. These should therefore be emphasized in the planning of the diet for cases of tetany with hypocalcemia.

Tetany due to alkalosis may be caused by an excessive intake of base-forming or alkaline compounds such as sodium bicarbonate, or by losses of the acids such as hydrochloric acid occasioned by prolonged vomiting. When tetany occurs from alkalosis, the treatment consists of the administration of acid therapy such as hydrochloric acid and a ketogenic diet (see Chap. 32).

Foods Rich in Calcium

Cheese of all kinds
Milk, whole, skimmed, evaporated or powdered
Egg yolk
Molasses
Shellfish:
  Clams
  Oysters
Vegetables:
  Turnip greens
  Mustard greens
  Kale
  Chard
  Cauliflower
  Dandelion greens
  Endive
  Celery
  Kohlrabi
  Rutabagas
  Okra
  Spinach
  Parsnips
  Carrots
  Beets
  Beans, string
  Beans, kidney
  Beans, Navy
Fruits, dried:
  Figs
  Dates
  Prunes
  Raisins

Foods Containing Vitamin D

Fish-liver oils
Viosterol
Vitamin-D milk
Salmon
Egg yolks
Butter
Cream
Liver

REVIEW QUESTIONS

1. Plan a day's menu for a patient with hyperinsulinism. He has had a diet of carbohydrate, 50 Gm.; protein, 100 Gm.; and fat, 160 Gm.

2. A patient with hyperthyroidism has a basal metabolic rate of plus 50. What does this mean? What type of diet will be prescribed for him?

3. How is hypothyroidism treated? Why?

4. What changes in metabolism occur in Addison's disease? What is the present procedure in treating Addison's disease?

5. A man has gout and is having an acute attack.

(a) Plan an adequate menu for a day from the foods given under List 4.

(b) Plan a week's menu which he may follow as an interval diet after his recovery from the acute attack. Use Hench's plan for a low purine diet.

(c) What foods should he avoid entirely?

(d) What measures may have to be taken to ensure the adequacy of a low purine diet?

6. What are the causes of tetany? How is it treated?

34

Preoperative and Postoperative Diets

Chapter Topics

PREOPERATIVE DIETS
  DIETS ADAPTED TO PATIENT
  SYMPTOMS REQUIRING ATTENTION
POSTOPERATIVE DIETS
  GASTRO-INTESTINAL-TRACT OPERATIONS
  COLON OPERATIONS
POSTOPERATIVE DIETS (CONT.)
  OPERATIONS ON THE MOUTH AND THE THROAT
  TUBE FEEDING
  BLOOD TRANSFUSIONS
  BURNS

PREOPERATIVE DIETS

The type of preoperative treatment given will depend upon the type of operation, whether minor or major, and the time interval before the operation. There are emergency cases and selected cases. Emergency operations do not permit of preliminary dietary treatment, even though the patient may have a serious complication, such as diabetes. In selected cases, however, the patient is prepared and put in the best possible condition for the operation, especially if the operation is to be a major one.

Diets Adapted to Patient

The dietary treatment of the patient in preparation for an operation depends on his condition, which is determined by physical examination and the various clinical tests, such as urine analysis and blood chemistry, including glucose and nonprotein nitrogen determinations. The conditions that may have to be combated in diseases requiring major surgery, such as lesions of the stomach, the duodenum and the biliary tract, are listed below.

Symptoms Requiring Attention

1. **Loss of weight,** strength and recuperative power. Every effort should be made in these cases to increase the intake of easily digestible foods, especially those of high carbohydrate content. To accomplish this the physician may find it necessary to give sedatives to induce rest and to relieve pain.

2. **Dehydration,** or loss of body fluids. This condition will probably exist if there has been vomiting, diarrhea or loss of weight. The remedy consists of filling up the reservoirs of the tissues with fluids—by mouth and, in severe cases, by intravenous or subcutaneous injections.

3. **Hypochloremia,** or loss of salts. The body chlorides may be lost through vomiting and through the urine. To remedy this condition so-

dium chloride is frequently given with dextrose intravenously.

4. **Loss of glycogen** from the body stores: the liver and muscular tissues. To correct this condition carbohydrates should be given abundantly. Fruit juices, glucose, corn sirup and hard candies are excellent sources. Dextrose may also be given intravenously.

5. **Hypoproteinemia,** or depletion of serum protein. A high protein, high carbohydrate diet or intravenous administration of protein hydrolysates, as well as blood transfusions, is given in preparation for surgery.

6. **Edema** or retention of body fluid in the tissues is often the result of low serum proteins.

7. **Anemia** frequently occurs in hemorrhagic lesions. Foods high in iron may be given, but time seldom permits the restoration of hemoglobin by this means of therapy. Blood transfusions are frequently given in these cases.

8. **Deficiency States.** One symptom is retarded gastric and intestinal motility, for which thiamine and vitamins of the B complex are given in foods, in brewer's yeast or as concentrates. They are needed also for normal heart action. Vitamin K is given when hypothrombinemia is present as indicated by blood tests. Ascorbic acid facilitates the healing process and vitamin A is thought to build up resistance of the epithelial tissues to degenerative changes.

9. **Retention of urea and other nonprotein nitrogen products** in the blood due to impaired renal function. Dextrose is administered intravenously and diuretics are usually given also.

10. **Ketosis** may exist due to lack of food and to the burning of body fats. The treatment for this condition is to increase the carbohydrate intake, either by mouth or intravenously.

General Considerations

Surgeons are emphasizing the importance of preoperative feeding as an important part of the preparation of the patient for surgery.

From the foregoing outlines it is evident that the dietary treatment in preoperative conditions must be given careful consideration. If any one of the conditions already mentioned exists, it should be treated before the patient is brought to operation, otherwise complications may result.

Improving the state of the patient's nutrition to withstand the shock of operation is another important consideration.

Carbohydrate should be forced not only because a liver well stocked with glycogen for energy is necessary but because it has protective value against liver damage by anesthesia.

Protein is necessary in large amounts, especially when hypoproteinemia and edema exist. It has been found more effective even than carbohydrate in the prevention of liver damage due to the toxic effects of the anesthetic. This is particularly important in diseases of the liver.

Fluid balance should be maintained. No patient should go to operation in a dehydrated state.

Special preoperative procedures may be necessary for certain conditions. For instance, if there is to be an operation on the large intestine or the rectum, a low roughage diet will be necessary for several days preceding the operation. Diabetics must be well controlled before elective surgery is undertaken. Patients with hyperthyroidism should be gaining weight before operation is performed.

All food is withheld just prior to the operation, however, as undigested food in the gastro-intestinal tract would cause serious difficulties. The length of time for the withholding of food depends upon the type of operation. For minor operations it is seldom necessary to give preliminary dietary treatment. In preparation for minor surgery no food is allowed on the day of the operation unless the operation is delayed until the afternoon, in which case a light breakfast of cereal, toast, coffee and fruit juices may be allowed.

For abdominal operations no food is allowed for a period of from 12 to 14 hours preceding the operation, but water is permitted until 2 or 3 hours before the operation.

Holman[1] summarizes the needs as follows:

"Surgical patients should, whenever possible, be prepared for operation by several days of optimum nutrition, including a well-balanced diet of high protein intake, of high caloric value and of high vitamin content. This period should begin at home 10 to 14 days before operation. . . . This preparation should also include vitamin concentrates for 5 to 7 days before operation."

POSTOPERATIVE DIETS

General Considerations

The state of nutrition of the patient following operation must be maintained. Owing to the toxicity of the anesthetic, nausea is likely to occur. After abdominal operations all fluids and foods are therefore withheld for from 24 to 48 hours, or even longer, depending upon the type of operation and the presence of infection, as in peritonitis. The need for calories is of prime importance since the glycogen supply will have been used up. Glucose given parenterally supplies this. Of even greater importance is the need for protein. It is necessary to keep up the serum proteins. Hypoproteinemia with the consequent edema produced has been shown to cause obstruction of gastro-intestinal healing. Proteins are also of importance in the healing of wounds when tissue synthesis is occurring as postoperative wound disruptions may take place. They are necessary, too, to maintain the body's ability to withstand infections. To supply needed protein the parenteral use of protein hydrolysates is becoming almost a routine procedure immediately following major operations.

The maintenance of fluid balance is also important. The normal avenues of fluid intake by beverage, food and metabolism of food are greatly decreased because of the inability to take anything by mouth. The usual avenues of excretion continue and may even be increased by vomiting, hemorrhage and exudation. The use of fluids by hypodermoclysis and intravenously are extremely important therefore and should be given immediately, after the operation, to prevent dehydration and shock.

Maintenance of salt balance is equally necessary. Salts may be lost by the same routes by which fluid is lost. The use of physiologic saline is indicated to help in replacement of the lost salts. Since fluids, salt, carbohydrate and protein are all necessary for the immediate needs of the postoperative patient, they may be given in one solution. Elman[2] uses a solution of 5 per cent protein hydrolysate, 5 per cent glucose and 0.2 per cent sodium chloride. One to 3,000 cc. of this solution may be given per day, thus providing the body with many important nutrients.

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[1] Holman, Emele: Surg., Gynec. & Obst. **70**:261, 1940.

[2] Elman, R.: J.A.M.A. **128**:659, 1945.

The first thing given by mouth is water in sips, no more than a tablespoonful during an hour. If preferred, bits of ice may be held in the mouth—thus supplying small amounts of water. If the sips of water do not cause vomiting, liquids in larger quantities are added. Tea without sugar or cream is usually the first liquid allowed other than water; clear broth and fruit juices may be added next.

Generally speaking, the dietary procedure following abdominal operations is as follows:

1st day—No food; no water to drink
2d day—Water in small amounts
3d day—Clear liquids
4th day—Soft diet
5th day—Soft or light diet
6th day—Light or general diet
7th day—Light or general diet

It is quite possible, however, that the condition of the patient may permit one or more of these steps to be omitted. For instance, the patient may be able to go from a soft diet to a general diet, thus omitting the light diet.

When a high protein intake is desired postoperatively and the patient can take food orally, concentrated sources of protein, such as protein hydrolysates, egg white, dried skim milk, and even gelatin, may be added to the foods of the diet to increase the amount of protein.

Gastro-Intestinal-Tract Operations

The dietary treatment following operations on the gastro-intestinal tract, however, may require even more careful planning and handling. Most surgeons have their own preferred dietary schedule which they wish to have followed. By way of illustration, however, the following dietary procedure for colon operations is given. The same diet is suitable for other gastrointestinal operations, such as gastric resections and gastrostomies.

A return to a normal diet is the ultimate aim in the treatment of patients who are recuperating from gastrointestinal surgery; but the patient should be warned that the return should be slow, additions being made gradually to the above schedule until a bland diet is reached. It may be wise to remain on the bland diet for several weeks, even months, to prevent recurrences of the previous condition. While on the one hand the patient must be cautioned about his diet, on the other hand he must not be made neurotic by the fear of a relapse. He must therefore be returned gradually but with certainty to a normal diet within a few months.

COLON OPERATIONS

In operations on the colon a nonresidue liquid diet, otherwise known as a clear liquid diet, is given. This diet is as follows:

Nonresidue Liquid Diet (*Clear Liquid*)

Tea, coffee, and coffee substitutes
Broth
Fruit juices, strained
Carbonated waters
Sugar and jelly
Fruit ices
Gelatin dessert without milk or cream
Toast water
Cereal waters

Following this, a more liberal residue-free diet may be given consisting of the above liquid diet to which are added heavy cream, eggs, butter, Melba toast, arrowroot preparations, cream of wheat, boiled macaroni, spaghetti, noodles or rice and plain gelatin desserts. This is soon followed by a smooth low-residue diet.

After Rectal Operations. Following an operation for hemorrhoids or other rectal operations, an opiate is usually given to prevent defecation. A residue-free diet is also given for 2 or 3 days to avoid the possibility of a bowel movement, and to lessen the pain of evacuation. A low-residue diet is continued to the fourth or fifth day, when honey and molasses or some other laxative food without roughage is given. An oil enema is frequently prescribed. Other bland but laxative foods may then be added.

DIETARY REGIMEN SUBSEQUENT TO OPERATIONS ON THE STOMACH OR THE DUODENUM [3]

Day After Operation	Time	Food	Amount
4	A.M. 8	Bland cereal * gruel	100 cc.
	10	Milk	100 cc.
	12 noon	Cream soup, strained	100 cc.
	P.M. 3	Gelatin, plain, with cream	100 cc.
	6	Bland cereal with cream	100 cc.
	8	Jello, plain, with cream	100 cc.
5	A.M. 8	Bland cereal with cream	150 cc.
	10	Gelatin, plain, with cream	150 cc.
	12 noon	Cream soup, strained	150 cc.
		Melba toast	½ piece
	P.M. 3	Baked custard	2 tablespoons
	6	Rice with cream	2 tablespoons
	8	Milk and cream	150 cc.
6	A.M. 8	Bland cereal with cream; sugar	150 cc.
		Egg, poached or soft cooked	1 egg
		Milk or Postum	100 cc.
	10	Gelatin with cream	100 cc.
	12 noon	Cream soup, strained	100 cc.
		Melba toast	½ piece
		Butter	½ square
		Milk or Postum	100 cc.
	P.M. 3	Baked custard	2 tablespoons
	6	Rice with cream	2 tablespoons
		Melba toast	½ piece
		Butter	½ square
		Milk or Postum	100 cc.
	8	Eggnog	150 cc.

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* Bland cereals include cream of wheat, cornmeal, farina, strained oatmeal.

[3] Sister Mary Victor: Surg. Clin. North America **20:** 1211, 1940.

Further Additions

Day After Operation	Time	Food	Amount
7	8 A.M. 12 noon 6 P.M.	Melba toast Pudding, bland Fruit purée, bland	½ piece 2 tablespoons 1 tablespoon
8	8 A.M. 12 noon 6 P.M.	Melba toast or rusk Potato, baked or mashed Potato, baked or mashed	½ piece 1 serving 1 serving
9	12 noon and 6 P.M.	Vegetable purée	1 tablespoon
11	12 noon and 6 P.M.	Cottage cheese or egg dish	2 tablespoons
14	12 noon	Chicken or fish	1 serving
15	8 A.M.	Orange juice Brewer's yeast	100 cc. 6 tablets
42		Tenderloin steak, lamb chops, tender roast beef, tender roast lamb, crisp bacon, unstrained vegetables	†

† The permissible unstrained vegetables include cooked carrots, beets, asparagus tips, squash, string beans and young tender peas.

OPERATIONS ON THE MOUTH AND THE THROAT

After a tonsillectomy or other mouth or throat operations, cold water only is allowed for the first 6 or 8 hours and ice cream is given as one of the first foods. Subacid fruit juices, milk and warm liquid foods are allowed the second day. Soft, bland foods, such as milk toast, custard, soft-cooked cereals and nonacid vegetable purées, may be taken the third and fourth day. The patient usually discovers what foods will slip down easily; and it may be several days before potato, dry toast or coarse vegetables can be swallowed comfortably.

TUBE FEEDING

There are occasions, either because of operation, accident or unconsciousness, when the patient must be fed by tube. If this type of feeding is to be continued for some time, it is important that the diet should be adequate and yet liquid in consistency.

Diet Formulas. The following diet supplies 79 Gm. of protein, 77 Gm. of fat and 291 Gm. of carbohydrate, and furnishes 2,173 calories. It is also adequate in calcium, phosphorus, iron and the principal vitamins. If desired, brewer's yeast (2 to 3 teaspoonfuls) and cod-liver oil (2 to 3 teaspoonfuls) may be added to the mixture. This quantity is divided equally into the

TUBE FEEDING *

Food	Measure	Amount	P Gm.	F Gm.	C Gm.	Minerals			Vitamins			
						Ca Gm.	P Gm.	Fe mg.	A I.U.	Thia-mine	C mg.	Riboflavin mg.
Milk	1½ qts.	1,500 cc.	53	60	74	1.77	1.40	1.1	2,400	.60	15	2.5
Cerelose or sugar	½ cup	120 Gm.			120							
Farina or str. cereal (enriched)	cooked ⅔ cup	120 Gm. 20 Gm. raw	2		15		.03	.3		.74		.1
Tomato juice	1 cup	240 cc.	5		10	.02	.04	1.0	2,520	.12	38	0.1
Molasses	½ cup	120 cc.			72	.32	.06	8.4		.10		.2
Eggs	3	150 Gm.	19	17		.08	.32	4.1	1,710	.18		.5
Salt	½ teaspoon	2 Gm.										
Calories 2,173		2,090 cc.	79	77	291	2.19	1.85	14.9	6,630	1.74	53	3.4

DIRECTIONS. Scald the milk in the top of a double boiler. Beat the eggs slightly and add the milk slowly, stirring all the time. Add the cerelose (or sugar) and cook in the top of the double boiler, stirring constantly until the mixture thickens slightly to form a thin coating on the spoon. Cool the mixture 15 minutes. Add the farina, tomato juice, molasses and salt. Stir well after the addition of each ingredient. Strain the mixture through a medium-fine sieve, pour into bottles with covers, label and place in the icebox. **Tube feeding should always be given at body temperature.**

NOTE. If a tube feeding is needed for a patient suffering from malnutrition and showing a low serum protein, protein hydrolysates may be added after the mixture has cooled.

* Manual of Diets, Presbyterian Hospital, New York City, 1943.

JEJUNOSTOMY TUBE FEEDING

Food	Weight Gm.	P Gm.	F Gm.	C Gm.	Calories	Ca Gm.	P Gm.	Fe mg.	A I.U.	Thiamin Int. mgs.	Ascorbic Acid mgs.	Riboflavin mgs.
Amigen	50	37.5			150							
20% cream	500	14.5	100	20	1,038	.4850	.4300	.0010	2,400 7,500	.10 .20		.75 1.00
Hom. milk	500	17.5	19.5	24.5	343.5	.5900	.4650	.0010	550 1,500	.20 .50	0-10	.90 1.20
Glucose	40			36	144							
Total	1,090	69.5	119.5	80.5	1,675.5	1.0750	.8950	.0020	2,950 9,000	.30 .70	0-10	1.65 2.20

SUPPLEMENT. Ascorbic acid, thiamine, iron.

DIRECTIONS. Mix amigen and glucose together in a bowl. To this mixture slowly add the homogenized milk to form a paste, then gradually add the rest of the homogenized milk and then the cream. Beat this mixture with an egg beater and then place it in the top of a double boiler and scald. Pour the mixture into a sterile bottle and, when cool, store in the refrigerator.

number of feedings specified by the physician.

The tube-feeding formula on opposite page is designed especially for jejunostomy cases. It is similar to the above tube feeding except for the fact that a protein hydrolysate, amigen, has been added as the chief source of nitrogen from which the body proteins will be built.

Blood Transfusions

It may not occur to the casual observer that the patient who receives a blood transfusion is really being given food. When it is remembered that the blood stream carries not only the products of protein digestion but glucose and fatty acids as well, it will be realized that blood does furnish actual nourishment. This fact is further proved by the way in which the recipient shows rapid and marked improvement. The treatment consists usually of from 250 to 500 cc. of blood given intravenously.

Burns

Severe burns are a surgical problem and usually require skin grafting in order to provide a covering for the injured area, from which there is massive loss of intracellular fluids, salts and serum proteins through exudation. There also seems to be an excessive loss of nitrogen through the urine. If these losses are not corrected, shock, toxemia, anemia and hypoproteinemia result. Plasma and whole blood are given immediately and protein hydrolysates are also given as soon as feasible. When food can be taken by mouth, a high caloric, high carbohydrate, high protein, high vitamin diet should be used. Harkins[4] *et al.* state that depending on the degree of burn, the calories should be from 3,000 to 5,000 per day, the protein from 125 to 300 Gm. per day, and adequate vitamins and iron should be given as medication. Individual consideration is extremely necessary to carry out the proper feeding of the patient with severe burns.

REVIEW QUESTIONS

1. Cite examples of patients you have seen that illustrate the symptoms requiring attention before operation can be performed.
2. Why is the treatment of hypoproteinemia of importance both preoperatively and postoperatively?
3. Why is food withheld from the patient just prior to operation?
4. How can a patient be given nutrients before he is able to take food by mouth?
5. What special procedures must be followed after a gastric resection, after a rectal operation, after operations on the throat?
6. Plan a tube feeding for a patient who must be fed by this means for several months. Show how it meets all the requirements for adequate nutrition.
7. What means can you take to get a severely burned patient who can take food by mouth to obtain a diet of 4,000 calories and 250 grams of protein?

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[4] Harkins, H. N., O. Cope, E. I. Evans, R. A. Phillips and D. W. Richards: J.A.M.A. 128:475, 1945.

35

Food Requirements in Diseases of Infancy and Childhood

Chapter Topics

INTRODUCTION
VOMITING AND REGURGITATION
COLIC AND FLATULENCE
MALNUTRITION
OBESITY
DIARRHEA AND DYSENTERY
CONSTIPATION
CELIAC SYNDROME
  CELIAC DISEASE, STARCH INTOLERANCE, PANCREATIC INSUFFICIENCY
INFECTIONS
OTHER CHILDHOOD DISEASES

INTRODUCTION

Children are subject to many diseases that are common to adults. The principles governing the treatment are the same, but adjustments must be made to conform to the requirements of age and general conditions. Just as the diet of a normal infant is different from that of the adult, so must the feeding of a sick child be different from that of the adult and somewhat different from that of the normal child. The diseases to which infants are most frequently subject and which require dietary control are malnutrition, overweight, diarrhea, constipation and infections. Deficiency diseases, especially rickets and scurvy, are also fairly common. Vomiting, colic and flatulence, while not diseases, are nevertheless symptoms which commonly occur and may require some dietary regulation.

VOMITING AND REGURGITATION

Vomiting may result from a number of causes and may or may not be a serious symptom. It closely resembles regurgitation when only small amounts of food are lost, while in vomiting the contractions of the stomach are sufficiently strong to empty the stomach. Persistent vomiting may be a symptom of infection, obstruction or other serious ailments. The occasional vomiting, however, is usually caused by overdistention of the stomach due to the ingestion of too large or too frequent feedings or to the swallowing of air. It may also be due to an imbalance of the food constituents, especially to an oversupply of fat, causing delayed emptying of the stomach. Vomiting may also be caused by sensitivity to certain foods. The cause should be determined and the feedings adjusted accordingly.

Regurgitation may be avoided by

belching. This is brought about by patting the child on the back and laying him on the abdomen or right side for a nap immediately after feeding.

COLIC AND FLATULENCE

Colic or abdominal pain of a paroxysmal nature may be caused by overdistention due to the swallowing of air, to gas formed by bacterial fermentation of undigested food, to irritation due to the use of cathartics or to cold. An undernourished child may have sufficiently severe hunger pains to cause colic. Flatulence usually follows an attack of colic. It may, however, be caused by bacterial fermentation, in which event the sugars of the food may be reduced or changed to a less fermentable type. It may be advisable to use protein milk or acidified milk. This is desirable also when there is inability to digest fat.

Since both colic and flatulence may result from swallowed air, it is important that the infant be "burped" to allow for the eructation of the swallowed air.

MALNUTRITION

Malnutrition is a condition of faulty nutrition due to insufficient or unsuitable food intake, or to a failure of the body to digest or absorb the food from the alimentary tract.

The symptoms are underweight, emaciation, a shrunken skin, ribs and bones visibly outlined, eyes sunken into the orbits and a subnormal temperature. Frequently there are other symptoms and complications, such as diarrhea, infections, anemia and dehydration. Severe cases of malnutrition are often termed marasmus, infantile atrophy or athrepsia.

The treatment prescribed will depend upon the cause. It is important first of all to determine the quantity of food consumed. If the baby is breast-fed, it should be weighed before and after feedings and the total daily intake computed. If the mother's milk is insufficient, supplementary feedings should be instituted. If the baby is bottle-fed, a careful check of the total food values, including protein, fat and carbohydrate, as well as calcium, phosphorus, iron and the vitamins, should be made to determine their adequacy. If the intake is lacking in calories or in any of the food constituents, the formula should be modified accordingly. This may be done by more frequent feedings or by increasing the quantity at the regular feedings. It may be made more concentrated by less dilution or by the use of the dried milk powders or evaporated milk and by the addition of sugars. In some cases it may be necessary to give one or more blood transfusions. Administration of protein hydrolysates is also recommended. In cases of dehydration, intravenous injections of saline or glucose may be helpful.

OBESITY

Overweight is due to an excess of food over and above the bodily requirement. This may be due in some cases to a lowered basal metabolism, but it is usually due to overeating or lack of exercise. The diet should therefore be calculated carefully and reduced in caloric value so that the weight loss is steady—usually not more than 1 pound per week. In cases of moderate obesity—that is, 10 to 15 pounds above the average—it is only necessary to maintain the child's weight at this level until he has grown to the height which would be normal for this weight.

Care must be taken to see that all the essential foods are given, including 1 quart of milk per day, 1 egg, at least 1 serving of lean meat, 2 cooked vegetables, 1 or 2 fresh vegetables and 2 to 3 fresh fruits, also 3 teaspoonfuls of butter or fortified margarine and 2 servings whole-grain or enriched bread.

For the younger child it is advisable to give fish-liver oil to supply the vitamins A and D.

The principles involved in the treatment are further explained in the chapter on underweight and overweight (see Chap. 20).

DIARRHEA AND DYSENTERY

Diarrhea is a common ailment of infancy and childhood, although it is less so than formerly, due no doubt to the more scientific handling of the milk supply. It occurs about four times as frequently in artificially fed babies as in breast-fed babies. Contamination of the milk may occur in the home even more frequently than in the dairy and the distributing plant. (See Chap. 14.)

Chief Cause. While contamination or spoilage of food is mainly responsible for diarrhea, other factors may be involved; for instance, a too concentrated formula, especially of the sugars and the fats, underfeeding and irregularities in feeding. Irritants such as cathartics are a frequent cause. Diarrhea may also be caused by an allergic reaction to food, cow's milk usually being the offender.

Because the passage of food along the alimentary tract is abnormally rapid in diarrhea, much of the food is either undigested or at least unabsorbed, therefore the child loses weight rapidly and soon shows symptoms of malnutrition which must be combated in the treatment. There is loss of water (dehydration), as well as loss of nutrients, and the gastro-intestinal tract is also in an inflamed condition. The first part of the treatment therefore consists of rest. No food should be given until vomiting subsides. Water should be given, however, either by mouth or parenterally. Water may usually be given, a teaspoonful at half-hour intervals, the amount being increased gradually and the interval lengthened. When feedings are instituted, the food should be very dilute, the concentration increasing as the condition improves.

Some form of acidified milk is best suited for this condition, first the skimmed and later that made from the whole milk. Still later, sugar may be restored gradually to the formula.

Therapeutic Agent. The use of apple, either in commercially prepared powder or as the scraped fresh fruit fully ripened, has proved to be excellent in the treatment of older children as well as of infants, owing probably to its pectin and its acid content. The scraped apple may be given every hour or two in quantities of 1 to 5 tablespoonfuls for 1 or 2 days. The apple powder should be mixed with water, 1 tablespoonful to 1 ounce of water. An infant should receive approximately 3 tablespoonfuls of the powder every 2 hours, day and night, varied according to the age and the specific requirement of the child. Banana powder is also an excellent food in cases of diarrhea, likewise cooked cereal (free from bran).

Dysentery is really a form of diarrhea but produced by a specific organism of the dysentery group. Its symptoms are more severe than diarrhea, including the presence of blood, pus and mucus in the stools, and unless properly diagnosed and treated may become recurrent or chronic.

Since the diarrhea of dysentery is caused by an infection of the intestinal tract itself, and may continue for an indefinite time before immunity is established, the principal concern of the nurse is to maintain the nutrition of the child. Food must be given regardless of the diarrhea, although it may be necessary to give smaller quantities if normal food intake results in increased diarrhea. The food should be low in fat, high in protein, with some limited amounts of carbohydrate. The acidified skimmed milk should form the basis of the diet for infants, but for older children cooked cereal may also be given.

Water must be given frequently and in increased amounts in order to replace the losses effected by the diarrhea.

For children of school age the same general principles as in the treatment of adults apply (see Chap. 26).

CONSTIPATION

Constipation in infancy is not infrequent, especially in artificially fed babies. Many mothers are concerned when the baby has only one bowel movement per day or alternate days. Mother's milk, because of a higher carbohydrate content than cow's milk, is more laxative than the latter. The number of movements per day is not of so much importance as the consistency of the stools. If the feces are expelled with difficulty, then the child may be said to be constipated and should be treated accordingly.

The formula may be made more laxative by the addition of (1) carbohydrate in the form of sugars, particularly lactose, or by a malt preparation; (2) fruit juices, especially prune or orange (or apple sauce for the older child); (3) whole-grain preparations, such as unstrained oatmeal or whole-wheat cereals; (4) puréed vegetables, supplying the finer form of fiber or bulk; (5) vitamin B_1 in the form of wheat germ, yeast or certain commercial preparations.

If constipation occurs in breast-fed infants, a supplementary feeding consisting either of malt extract in water or of diluted prune juice may be given prior to a nursing period. In older children a variety of dried fruits, especially prunes and figs and other fiber-containing foods, may be given once or twice daily. (See Constipation, Chap. 26.)

CELIAC SYNDROME

Several conditions resembling celiac disease have now been distinguished from it. Besides the classical celiac disease, two other conditions are similar: starch intolerance and pancreatic insufficiency.

Classical Celiac Disease. This is a type of chronic intestinal indigestion occurring chiefly in young children. The onset is gradual, beginning usually after the first year of life, and occurring frequently as late as the fifth year. Indeed, it may be seen at any age. Little is known concerning its etiology, but there is a low tolerance for both fats and carbohydrates, especially the disaccharides and the polysaccharides, probably due to lack of absorption from the intestinal walls and to faulty utilization of these food constituents. It is known that the pancreatic enzymes are present in normal amounts in the juice of the duodenum, hence the conclusion is drawn that the cause of this disease is lack of assimilation rather than failure of digestion.

The symptoms are:

(1) A prominent protruding abdomen.

(2) Voluminous, pale stools, semifluid, frequent, foul smelling and of high fat content. The daily output on successive days is surprisingly large.

(3) Loss of weight or stationary underweight persisting for months or even years without discernible cause.

(4) Marked edema of the face and the extremities, tongue sore and red.

(5) Marked retardation of growth.

(6) Loss of appetite, vomiting, secondary anemia and excessive irritability are also frequently encountered.

Dietary Treatment. The course of celiac disease is long and stubborn and, as one writer remarks, "The cure of this unique disease is as mysterious as its origin."

Clinicians agree that the only effective treatment is proper diet. Protein forms the basis of the diet, since it is the only food constituent which is digested and absorbed without difficulty. The carbohydrate of bananas is an exception to the findings already stated, since it is generally well utilized when derived from ripe fruit, whether baked or raw or given as banana powder.

Modified milk may be used in the diet. Hass[1] recommends protein milk which may be prepared in the home or made from commercial powders. Jeans and Rand[2] state that because of its fat content, even though low, it is not always tolerated, in which case boiled skimmed milk is recommended. They outline the following as suitable for the initial diet of a 2- or 3-year-old child: "30 ounces of boiled skimmed milk, 2 to 3 egg whites, 1 ounce of cottage cheese, 1 ounce of sieved liver, 6 to 7 ounces of dextrose, 8 ounces of strained orange juice, 8 ounces of sieved tomatoes, beef juice and 1 to 2 teaspoonfuls of cod-liver oil or the equivalent in other fish-liver oils that may be more potent. The dextrose may be given in 10- to 20-per-cent solution, flavored with orange juice." They find that dextrose is well utilized when given at intervals between meals. Great care must be taken that no starch enters the diet for a period of several months, usually for more than a year. Fat is returned to the diet earlier than starch. After continued improvement is noted, other sources of protein may be added, such as finely chopped lean meat or chicken or gelatin prepared without sugar. It may, however, be sweetened with saccharine. Strained vegetables and puréed fruits are added later. It must be remembered that all additions to the diet should be made gradually, beginning with very small amounts.

Marriott[3] states that by the end of 6 months or a year, a typical diet would be as shown on next page.

Marriott then adds: "No further additions should be made for a long time. Particularly to be avoided are butter, cream, ice cream, fats, fried foods, pork, bacon, potatoes, candy and cake."

Starch intolerance, the exact cause of which is not definitely known, occurs more frequently than classical celiac disease. The stools are frothy, foul smelling, high in starch but normal in fat content. There is decreased amylase in the pancreatic juice which is secreted into the duodenum. The prescribed diet, therefore, is low in starch, the carbohydrate coming from

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[1] Hass, S. V.: J.A.M.A. **99**:448, 1932.

[2] Jeans, P. C., and W. Rand: Essentials of Pediatrics, Philadelphia, Lippincott, 1946.

[3] Marriott, Wm. McK.: Celiac Disease in Practice of Pediatrics, compiled by Brennemann, published by W. F. Prior, Hagerstown, Md., 1937.

Boiled whole milk (or whole lactic-acid milk, or equal parts of evaporated milk and water)	1 qt.
Cottage cheese	1 oz.
Whole eggs (boiled or coddled)	2
Boiled liver, alternating with ground beef, fish or chicken	2 oz.
Corn sirup	4 oz.
Puréed fruits (dried peaches, sieved stewed pears or apricots)	3 oz.
Strained tomato, peas, squash, string beans or carrots	6 oz.
Cornflakes	1 oz.
Well-cooked rice (1 hr.)	1 oz.
Dextrinized toast	1 slice

sugar, honey, fruits and strained vegetables; the protein is normal, all types are allowed; and the fat is normal. Starch, such as cereals and bread, cannot be added for long periods of time, if at all.

Pancreatic Insufficiency. Cystic fibrosis of the pancreas is a congenital disease resulting in pancreatic-enzyme insufficiency. It is characterized by widespread change of the mucus-secreting glands of the entire pancreas. The stools contain both fat and protein. The pancreatic enzymes are markedly decreased or entirely absent. The diet is high caloric (30 to 50 per cent above normal requirement), average carbohydrate, with the simple sugar supplying the greatest part since starches are not well tolerated. The protein is high and fat moderate. There should be a high vitamin A intake. Pancreatin is given with each feeding to help in the fat digestion.

INFECTIONS

Infections characterized by fever usually impair the appetite. It is not necessary to restrict food intake during the acute stages but the infant or child should be fed according to his appetite. He should be encouraged to take fluids freely and to return to regular food intake as soon as possible. As the fever subsides the appetite usually becomes progressively better and the food intake increases accordingly. If the illness has been prolonged with loss of weight, liberal feedings are indicated. (See Fevers and Infections, Chap. 21.)

In urinary and renal infections, such as cystitis, pyelitis and pyelonephritis, the treatment is the same as outlined in Chapter 20. For chronic infections such as tuberculosis see Chapter 21.

OTHER CHILDHOOD DISEASES

Diseases resulting from dietary deficiency, especially those of the vitamins, are quite frequently observed in children. These diseases have been discussed in detail in the chapter on deficiency diseases (Chap. 22).

Epilepsy rarely occurs during infancy. When there is a predisposition it usually develops in boys at about 12 years of age and in girls at about 16 years of age. The dietary treatment is discussed and outlined in Chapter 32.

Diabetes mellitus is a disease of childhood as well as of adult life. It is fully discussed in Chapter 23.

As stated previously, children are subject to almost all the diseases common to adults. They may be allergic to foods with all the attendant symptoms mentioned in the chapter on allergy; they may be subject to gastro-intestinal diseases other than those described in this chapter; and they may have dental caries. For all such diseases consult the chapter on the subject in Part Two.

REVIEW QUESTIONS

1. What modifications of diet may be indicated to treat vomiting? Colic and flatulence?

2. What are some of the causes of malnutrition in children?

3. How many calories and how much protein does a child 2 years old require?

4. What advice would you give a mother whose child was overweight?

5. What are the causes of diarrhea and dysentery? What dietary measures are indicated for each?

6. What additions can be made to the feedings of an infant having constipation? Why?

7. What diseases are included in the celiac syndrome?

8. What type of diet is indicated for the treatment of the conditions included in the celiac syndrome? Explain the reason for each type of diet.

9. Plan a day's diet for a child with celiac disease.

10. How are acute fevers in childhood treated?

11. What other diseases besides those already mentioned may children contract?

Part Three

FOOD SELECTION AND PREPARATION

INTRODUCTION

Through food selection and preparation the principles of modern science and nutrition can be applied practically. For untold centuries food was sought solely for the satisfaction of hunger and the preservation of life. Cookery was looked upon as the means by which food, otherwise inedible, could be prepared for consumption.

As trade and agriculture developed, the food supply became more stable, and it became possible to count upon more than the immediate satisfaction of the hunger instinct. It was not until this period that cookery began to develop as an art, and appetite appeal became a consideration. The criterion for well-being became "plenty of good food." Eventually custom decreed the division of the day's food into three meals. Where food was plentiful, the menus for breakfast and the midday and the evening meals differed very slightly in any respect.

As the provision of food, with changing industrial conditions, became a large-scale business all year round, supplies of an ever-increasing number of foods became available. Certain items increased materially in cost, while others, because of volume production, became less expensive. Improved transportation and the development of refrigeration have made possible the supply of fresh meats, milk, fruits and vegetables throughout the year. New methods of food preservation have provided an ever-increasing range, first of canned products and then of frozen foods. These factors have made possible the application of the new knowledge of nutrition to food selection. Nowadays the choice is limited in general only by the amount of money that can be allotted for the purchase of food. Today it is not only the preparation of food from the point of appetite appeal that is of interest, but the preservation of its natural values, which are now known to be affected by the methods used in preparation.

It is important for the nurse, in the interest of her own health and the enjoyment of her daily meals, to know how to choose and prepare food so that it will be good in every sense of the word. She will be called upon frequently to handle the food problems of her patients. In some cases it may be necessary for her to prepare meals, or portions of them, with her own hands. She may often have the responsibility of planning and serving suitable meals. In public-health service she will be required many times to advise and instruct concerning the choice and the preparation of economical, nutritious food.

The following chapters, which cover both food selection and cookery, provide much more material than can possibly be included in the hours devoted to the subject during the student's training course. They have been arranged more with a view to convenience than to the nutritive importance of the subjects. The first few chapters, therefore, are devoted to beverages, which are a natural accompaniment to meals, and to milk, fats, sweets and seasonings, all of which are used most often in connection with other foods.

The authors hope that both the background material and the wide selection of recipes will be of value to the student after graduation, not only in her profession but in her own personal problems of food selection and preparation.

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Introduction to Food Selection and Preparation

Chapter Topics

ADEQUATE MENU FOR A DAY	MEASURING
FOOD FOR THE PRIVATE PATIENT	COOKERY TERMS
USE OF RECIPES	CARE OF UTENSILS AND DISHES

Food selection in a broad sense covers more than the choice of an adequate amount of variety foods. It includes planning for the day good meals which will be not only adequate nutritionally but satisfying to the appetite and to the taste. Foods which contrast in food value, color, flavor and texture, and which blend, or, as it is often expressed, "go together," should be chosen to make up a meal.

ADEQUATE MENU FOR A DAY

An adequate and an attractive menu for a day can very easily be planned on the basic dietary pattern which was discussed in Chapter 12. This can be varied from day to day, as well as from week to week, and there need be little repetition of the various items which make up a meal unless, as may be the case when it comes to breakfast, there is a preference for one type of menu. The basic dietary pattern, which includes one pint of milk, one serving of meat, one egg, one serving of some other protein food, two servings of fruit (one of the citrus variety, or tomatoes), one serving of a green or a yellow vegetable, one serving of another vegetable, one small potato, three slices of whole-grain enriched bread, one serving of another cereal of the same type, three pats of butter or margarine, will provide an adequate, or almost adequate, amount of every dietary essential excepting calories. This allows for the use of sugar and shortening, which add so much to the texture and the flavor of so many cooked dishes; for the use of butter, cream or oil as dressing for vegetables and salads; and for the inclusion of extra fruit and other foods which have appetite appeal. The total amount in excess of the basic pattern will depend upon the caloric requirement rather than on the appetite alone.

It is not necessary to make any dietary calculation in planning meals for the normal person. It is good practice, however, to consider weight as one of the indications of normality. If weight is greater than average, menus should follow as closely as possible the basic pattern without caloric additions. If weight is under, it may be well to increase the amount of milk and eggs and to choose or provide foods which will especially tempt the appetite. Food will often alleviate fatigue and a condition which is often known as nervousness, both of which may be either contributing causes or symptoms of underweight.

The three-meal-a-day plan is generally accepted. There should be no omission of breakfast, which should be adequate, although not necessarily heavy. The main meal of the day may be served at noon or in the evening, to suit convenience and preference. The basic pattern calls for meat, potatoes, some other vegetable and a dessert, with the addition of a salad if not used at another meal. The same general plan may be followed for the lighter meal, either luncheon at noon or supper in the evening, when a supplementary protein other than meat may be the main dish. This may be in the form of a soup made with a milk base, or an egg or a cheese dish. Such dishes will sometimes be used as the main source of protein. Recipes will be found in Chapter 42 (Eggs), Chapter 44 (Cheese) and Chapter 40 (Cereals). Recipes for use of dried vegetables (legumes), which are also high in protein, will be found in Chapter 51 (Family-size Inexpensive Recipes). A dessert, which adds satisfaction to both luncheon and dinner, gives another opportunity for the use of milk and eggs.

The preparation of each meal depends first of all upon having all ingredients on hand. The order of preparation of each dish, so that all may be ready at the meal hour, should be considered first. If a baked product is in the meal plan, the oven should be preheated at the proper temperature and time should be allowed for this as well as for baking. The time indicated for the proper cooking of meat, fish, eggs and vegetables should be estimtaed in order that they may be served as soon as they are cooked. Salad ingredients should be taken out of the refrigerator, where they have been placed in order to be crisp, and put together just before serving time. The table or tray should be set so as to be ready when the food is at its best. Dishes for hot food should be warm, while those for cold food should be cold or even chilled in the refrigerator.

FOOD FOR THE PRIVATE PATIENT

One of the responsibilities of the nurse is to make sure that the patient for whom she is caring at home is provided with appropriate, well-cooked and attractively served food. When the patient is seriously ill, the demands may be such that the nurse will have no time for actual preparation of the food itself, but she may have to make suggestions as to how the doctor's orders should be carried out. This is particularly important when the condition of the patient demands the restriction of certain foods. The most common demand upon the nurse on a private case is during convalescence, when it is often important to tempt the appetite. The food preferences of the patient must be considered as far as possible, and if foods to which there is a prejudice must be included, they should be made as attractive as possible in seasoning or flavor and in appearance.

While it is usually preferable, when possible, to plan the patient's meals as a modification of the regular family menu, it may be necessary for the nurse to undertake the preparation of special dishes or of whole meals. When this is the case, she must plan to cook in small quantities and yet in amounts large enough to ensure successful results. It is impossible to prepare certain dishes in individual quantities, and in such case the leftover portion may sometimes be used the next day or some other member of the household may share the patient's food. Whether or not the nurse prepares the food, she should take the responsibility of seeing that the tray is attractively arrnaged with clean, crisp linen and suitable dishes heated or chilled as the case may be. In the dull days of convalescence, mealtime may be an event, and by the nurse's aid in making it a pleasant occasion, recovery may actually be hastened.

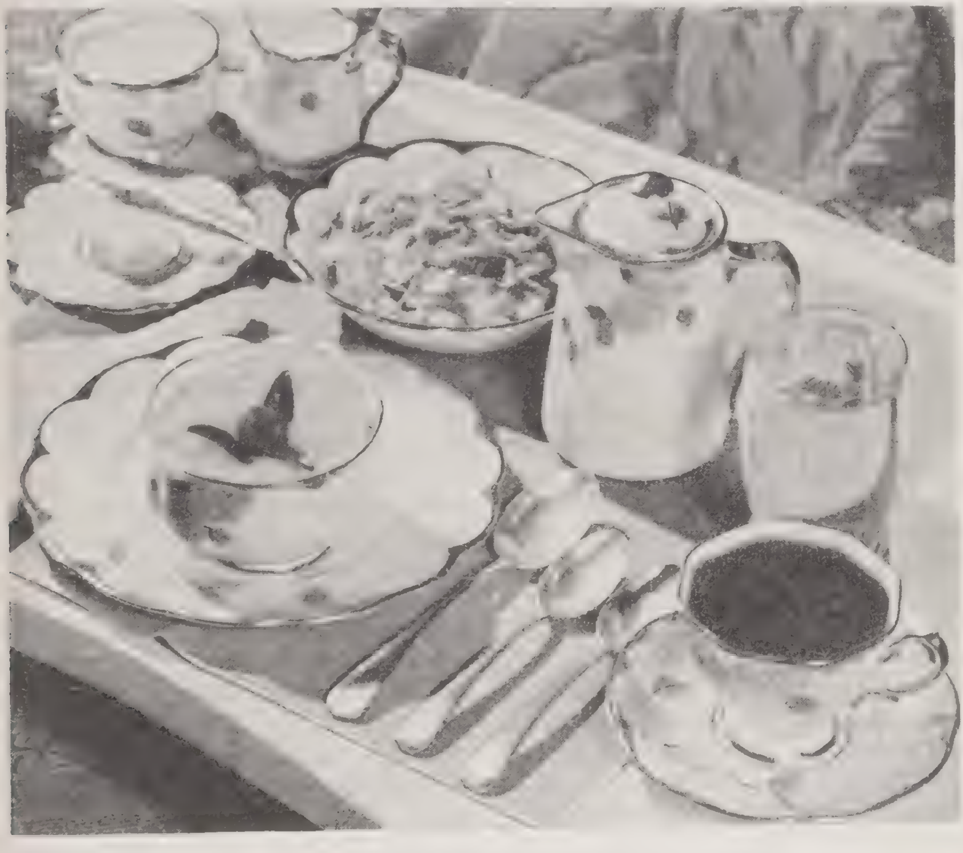

Fig. 76. An attractively set tray tempts the appetite.

Simple garnishes which contrast in color with the food often make a dish more tempting. Fresh sprigs of parsley, strips of pimiento or green pepper may often be used to good advantage with main dishes. A few berries, cherries, strips or segments of other fruits of bright color may add an interesting note to a plain dessert. A flower laid on the tray or placed in a low vase which cannot easily be upset may add a finishing touch. It is worth while to take pains with the preparation and the service of food for the invalid.

USE OF RECIPES

A recipe is a formula by which the proportions of the ingredients have been found by experiment to produce desirable results when combined according to the directions in the method. A recipe should be carefully read and ingredients should be assembled before food preparation is begun. The recipes in the following chapters are for as small quantities as possible to ensure successful results.

The use of small utensils for the preparation of small recipes is an aid to success. A pint saucepan, a very small double boiler, a small strainer, a small drip coffee pot and a small teapot will make the preparation of small quantities easier and more successful than would otherwise be the case. It should be noted that the time allowance for small recipes is usually shorter than for the preparation of those of family size. Most small-quantity recipes prepared on top of the stove should be cooked over low heat. Temperature and time should be carefully regulated when individual baking dishes are used.

MEASURING

For the successful use of a recipe accurate measurements are important, particularly in the case of flour, sugar, shortening and leavening agents such as baking powder and soda. Flour and confectioners' sugar must be sifted before measurement.

For the sake of texture and flavor, certain variations may be made according to taste after the basic preparation has been accomplished. At this time, for instance, more liquid may be added to a soup or sauce recipe and more seasoning may be added to taste to any dish. In fact, the cook should form the habit of tasting with a critical palate every dish which she prepares before serving.

For accurate measuring the following utensils are essential: An eight-ounce measuring cup divided into fourths and thirds or a set of measuring cups of the above volumes; tablespoons and teaspoons of regulation sizes or a set of measuring spoons.

To measure a cupful of a dry material, fill the cup lightly with a spoon, a little above the brim, and level with the cutting edge of a knife. Do not shake the cup to level the materials. This is particularly important in the case of flour sifted before measurement. To measure fat, pack firmly into cup to the desired mark of measurement. Except for pastry, fat should be at room temperature. (An easy method to measure half a cup of shortening is to fill cup to half mark with cold water and add shortening enough to cause water to rise to the one-cup mark. To measure a quarter of a cup, fill with cold water to the three-quarter mark.) Before measuring honey or sirup, always rinse cup with cold water first.

To measure dry ingredients by the tablespoon or teaspoon, fill until heaping and with the cutting edge of a knife brush off all that extends above the edge of the spoon. If one half spoonful is desired, divide the contents of the spoon lengthwise and push off one half. If one fourth is wanted, divide the remaining half crosswise of the spoon and push off the portion not desired. If one eighth is desired, divide the remaining one fourth crosswise and push off the portion not needed. If one third of a spoonful is desired, divide the contents of the spoon crosswise into thirds, pushing off the undesired portion.

To measure spoonfuls of liquid dip the spoon into the liquid.

To measure butter or other solid fats, pack solidly into the spoon and level with a knife.

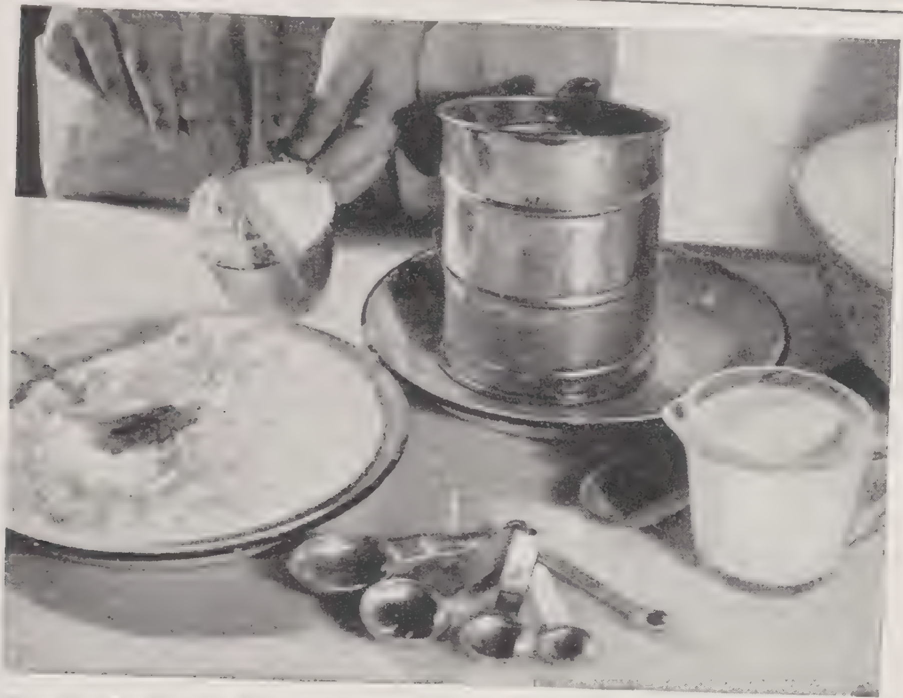

FIG. 77. Only level measures are accurate measures. (Bureau of Home Economics, U. S. Department of Agriculture.)

TABLE OF MEASURES AND APPROXIMATE WEIGHTS

3 teaspoons	1 tbsp.
16 tablespoons	1 cup
½ cup	1 gill
2 cups	1 pt.
4 cups	1 qt.
2 pints	1 qt.
4 quarts	1 gal.
1 tablespoon butter	½ oz.
* 1 tablespoon liquid	½ oz.
1 tablespoon flour	¼ oz.
1 tablespoon sugar	⅗ oz.
* 1 cup liquid	8 oz.
1 cup flour	4½ oz.
1 cup butter	8 oz.
1 cup sugar	10 oz.

* Water or milk.

THE METRIC SYSTEM AND ITS EQUIVALENTS[1]

The metric system of weights and measures is commonly used in all types of scientific work. Dietary prescriptions are usually written in this system. The unit of volume is the liter (approximately 1 quart) of water which weighs 1,000 Gm. or 1 kilogram.

Below is given a table of metric weights and measures and their equivalents. When preparing weighed diets

1 liter (by volume) = 1,000 cubic centimeters (cc.) = 1.06 qts.
1 liter (by weight) = 1 kilogram (Kg.) = 1,000 Gm. = 2.2 lbs.
1 oz. = 28.34 Gm.
1 Gm. = 1 cc.

1 tsp. = 5 cc.
1 tbsp. = 14 cc. approximately figured at 15 Gm.
2 tbsp. (1 oz.) = 28 cc. " " " 30 "
1 cup = 225 cc. " " " 240 "

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[1] For additional equivalents see Tables, Part Four.

extreme accuracy is necessary, but for rough estimates approximate figures may be used.

COOKERY TERMS

Cream: To soften shortening and to blend with sugar by rubbing with a wooden spoon.
Cut in: To blend shortening with flour with pastry blender or two knives.
Dice: To cut in small square pieces.
Fold: To add whipped cream or beaten egg whites with a careful cutting motion.
Mince: To cut or chop fine.
Purée: To press food through a sieve.
Sauté: To cook in a small amount of fat.
Sear: To brown quickly over direct heat or in oven.
Shred: To cut or tear in thin strips.
Simmer: To cook in liquid just below boiling point.
Steep: To let stand in hot liquid below boiling point.

CARE OF UTENSILS AND DISHES

Intelligent planning for the use of utensils and dishes and their care after use is a factor in efficient food preparation. This includes the following points:

1. When both dry and liquid materials are to be measured, use the measuring cup first for the dry ingredients, then for the liquids.

2. Rinse cooking utensils as soon as possible. Use hot water for those which have contained sugar, sirup or fat. Wipe greasy utensils with soft paper before rinsing. For eggs or starchy ingredients, use lukewarm water.

3. Wash cooking utensils as soon as possible. This makes meal preparation and dishwashing neater and easier.

4. When water is hard, a water softener is recommended before soap is used. A "soapless soap" which is a detergent may replace both water softener and soap.

5. Order of dishwashing: Rinse dishes and stack in an orderly pile to the left of sink. Wash in order glass, silver, small table dishes, then serving dishes. Place washed dishes in drainer and rinse with very hot water, or rinse in very hot water and place on towel. Place dried dishes on tray to return to cupboards.

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Beverages

Chapter Topics

BEVERAGES IN THE MENU
- COFFEE
- TEA
- HERB TEAS
- COCOA AND CHOCOLATE
- COLD BEVERAGES
- ALCOHOLIC BEVERAGES

GENERAL RULES AND RECIPES FOR BEVERAGES
- COFFEE

GENERAL RULES AND RECIPES FOR BEVERAGES (CONT.)
- TEA
- COCOA AND CHOCOLATE
- MILK AND EGG BEVERAGES
- FRUIT BEVERAGES
- WINE BEVERAGES
- HIGH CALORIC BEVERAGES
- HIGH PROTEIN BEVERAGES
- DIABETIC BEVERAGES

BEVERAGES IN THE MENU

A meal is incomplete in the opinion of most people without a beverage, which in its simplest form may be a glass of cold water, chilled with ice if desired. This is usually part of the service of the invalid tray, even if an additional beverage is served, unless there is some reason for limiting liquids in the diet. The old prejudice against drinking water with the meal has been overcome, although water or other cold beverage should be sipped rather than taken in gulps to wash down food, which may not in this case be properly chewed.

With few exceptions everyone enjoys a hot beverage on the breakfast table. Usually coffee is the choice, and it may also be the preference with other meals. Some persons prefer tea at breakfast, but it is more commonly used at other meals. Cocoa is a good choice for the children's breakfast, especially if a cold rather than a hot cereal is served. A few older persons take cocoa for breakfast, and may enjoy it, as will the children for lunch or supper. For most children, however, milk is the indispensable beverage at every meal.

Coffee and tea have no food value unless served with cream and sugar. Cocoa in itself will increase the food value of the milk which is used in its preparation. Coffee, tea and cocoa all have a certain amount of stimulating power. Generally this is an asset, especially at breakfast time.

A cold beverage other than water may be used at any meal, with the exception of breakfast, especially in warm weather. Iced coffee, tea or cocoa, a carbonated beverage or a fruit drink are usually chosen. These beverages, however, are used all the year round between meals as a refreshment. Milk, eggnog and other cold beverages made with milk or with milk and eggs are valuable for serving between meals when the caloric or protein content of the diet needs to be increased. Wine and other liquors which are occasionally used to provoke appetite or to stimulate or flavor furnish additional calories.

Hot beverages should be really hot when they reach the patient and cold beverages really cold. The former is particularly important, as a lukewarm cup of a beverage which is supposed to be hot may ruin the enjoyment of an otherwise good meal.

COFFEE

Coffee is obtained from the berry of a tropical tree which bears fruit all the year. The beans are removed from the berry, dried, cured and hulled before they are sent to be roasted in the countries where the coffee is to be consumed.

Blends of various kinds of coffee are used to produce the special aroma and flavor typical of an individual brand. The period of time allowed for roasting also affects the flavor. The roasted beans must be ground in order to allow the water to come in contact with as large a part of the coffee substance as possible. The fresher the grind, the better the flavor of the beverage. As coffee is seldom ground at home today, it should be purchased either freshly ground or in vacuum containers. After a container is opened and the coffee comes in contact with air, loss of flavor begins. It has been found that loss is delayed by keeping coffee in a cool place. Theoretically, the finer the grind, the greater the flavor released. The choice of steel-cut or drip-grind coffee will depend upon what type of coffeepot is used.

The coffee berry in its natural form has some food value and is still used in certain Eastern countries as a food ration when powdered, mixed with fat and made into balls. In beverage form, as taken in the United States, however, it merely provides stimulation. Among its soluble constituents is caffeine, amounting to about 1.24 per cent. Caffeine is a stimulant which acts upon the heart and the nervous system. It is not, like most other stimulants, followed by depressing effects. Its effect, however, upon the individual is variable, as some persons are exceedingly sensitive to its stimulating quality, while others are less affected. While authorities differ concerning the harmfulness of the moderate use of coffee by adults in good health, all agree that it should never be given to children.

Caffeine may be removed to the extent of 95 per cent or more. Decaffeinated coffee is marketed under several trade names. It retains the coffee flavor and is prepared in the same way as other coffee. Decaffeinated coffee is often prescribed by physicians.

Tannin is another of the soluble products which may be found in the decoction. Caffeine is very soluble and is dissolved very quickly when once the liquid comes into contact with the ground beans. The tannin, however, requires several minutes for its complete extraction. Long boiling or standing on the grounds brings out a characteristic bitter flavor. The ordinary cup of coffee, as it is made in the United States, contains from two to three grains of caffeine. Strong coffee may contain as high as four grains per cup; but the amount of tannin will depend largely upon the method by which it is made, as it increases with prolonged cooking.

Fig. 78. Coffee should be poured after the tray is ready.

MAKING COFFEE

Four different methods, each adapted to the type of coffeepot, are in general use. Coffee of a medium grind should be used for boiling and percolating. A finer grind, known as drip grind, is for drip and vacuum pots. Experiments by the Massachusetts Institute of Technology show that the temperature of the water is of great importance, and that a temperature less than boiling during the period while the coffee is in contact with the water produces the best flavor. When boiling water is used in a drip coffeepot, the contact with the cold coffee decreases the temperature to the proper point. For fine flavor, the drip method is recommended. Research by Leslie H. Backer of the

Stevens Institute of Technology shows that a drip beverage should never be poured through the grounds a second time. Flavor may actually be lost by a second dripping. Professor Backer's experiments showed that water should not be in contact with ground coffee longer than five minutes, regardless of the method used. The reason for this is that while about 25 per cent of the coffee is soluble in water, not more than 85 per cent of the soluble portion should be extracted for a beverage of the finest flavor.

In an effort to improve coffee brewing, the National Coffee Association is now offering a seal of recommendation for coffee-brewing devices which pass tests in producing brewed coffee of fine flavor, aroma, strength and clarity. To receive approval, the devices must be simple to operate, easy to clean and complete brewing within a reasonable length of time. The device must be made of material which does not contaminate the brew with a foreign or undesirable taste.

All research in brewing coffee shows the importance of a clean pot. It is not difficult to remove all traces of coffee oils when a glass, pottery or enamel pot is used. A metal pot absorbs the oils. It should, therefore, be thoroughly washed in soapy water and the spout scrubbed with a brush. After rinsing in hot water, there should be no detectable odor of coffee. If a metal pot is not so washed, the oil of the coffee may be absorbed by the porous metal, become rancid and spoil the flavor of a fresh brew. Coffee prepared in a metal pot should be served as soon as it is brewed, as the flavor changes very quickly.

General Rules for Brewing Coffee

General rules for brewing coffee by any method follow. For detailed directions for each type of coffeepot, see page 408.

1. Use freshly roasted and ground or vacuum-packed coffee. Keep coffee in refrigerator or other cool place in covered glass jar. Scald jar before refilling with coffee.
2. Use grind suitable for type of pot.
3. Use pot of size suitable for amount to be brewed.
4. Measure coffee and water accurately.
5. Use freshly boiling water.
6. Serve beverage as soon as brewed.
7. Never reheat the beverage.

Cereal beverage preparations made from roasted grains which possess no stimulating qualities are sold as coffee substitutes. One form may be prepared by any coffee method. Another is so fine and is treated in such a way that it will dissolve instantly in boiling water.

Coffee extenders such as roasted chicory and malt are sometimes mixed with ground coffee.

TEA

Tea as a beverage is the infusion made from the leaves of *thea,* an evergreen bush. The shrub is not allowed to grow to a height to exceed 5 feet. The leaves are lance-shaped and vary considerably in length. The smaller and the younger leaves produce the more delicate flavor and, therefore, demand the higher prices. The very tender young leaves at the end of the branches make Orange Pekoe, or Flowery Pekoe tea. Flowery Pekoe is scented, the scent being produced by allowing certain fragrant flowers to be held in contact with the tea during the process of preparation for the market. Orange Pekoe is so called because the infusion made from it is orange in color. The next larger leaves are called Pekoe; the next Souchong; and those still longer are Souchong, No. 2 or 3, the ordinary varieties of tea.

After the leaves are gathered, they are put into trays or upon shelves and allowed to dry or wither in order to reduce the amount of moisture in them. They are then twisted by being passed through rollers to extract more of the moisture. The leaves, as they come forth from the rollers, twist or roll, which gives the process the name. The masses of rolled leaves are then broken up, and, if green tea is desired, they are then fired. For this purpose they are spread thinly upon trays and placed in a current of hot air until thoroughly dried. They are then cooled and sifted or sorted according to sizes, when the tea is ready for packing.

If black tea is desired, the leaves are fermented before they are fired. This is accomplished by spreading wet cloths over the leaves and then allowing them to ferment until they attain a copper color, the color which is desired after the infusion is made. Successful fermentation requires much experience, as the tea may be easily spoiled by overfermentation. The difference between green tea and black tea, then, is simply that one is fermented and the other is not. Oolong teas are a cross between green and black teas, although they are ordinarily classed as black teas; they are fermented only slightly so that they partake somewhat of the flavor of the black tea, but have more of the color of the green tea.

Tea contains practically the same constituents as does coffee. The principal ingredient is theine, similar to caffeine. Tannin is likewise found, as well as a small amount of an essential oil which gives it its flavor and aroma. It is important that tea should be made just before serving. According to Hutchinson, an English author, one cup of tea as ordinarily made "contains about one grain of caffeine and twice or three times as much of tannic acid." This statement probably refers to the way it is made in England, where it is usually stronger than in this country. The physiologic effects of tea are much the same as those of coffee. Most persons, however, seem to be more susceptible to the effects of coffee than to those of tea.

HERB TEAS

Infusions of various herbs are used in beverages and called tea. With the exception of maté, from a South American shrub, they are generally lacking in stimulation but are pleasant and refreshing.

MAKING TEA

Tea making should be done with a view to extracting as little of the tannin as possible while at the same time extracting the flavor. Therefore, the water should be boiling when it is turned upon the leaves, and the pot containing the tea should also have been heated previously in order not to reduce the temperature of the water. Fresh cold water should be brought to boiling point and *immediately* poured over the leaves, otherwise the infusion will have an insipid flavor. The infusion should not be allowed to steep for more than five minutes, when it should be turned into another pot; or the tea may be tied in a cheesecloth bag and removed from the pot after standing the necessary time.

COCOA AND CHOCOLATE

Cocoa and chocolate are produced from cocoa beans, which grow in pods from about 5 to 8 inches long upon a tropical (or subtropical) tree known as the *Theobroma cacao*. When the pods are ripe the beans are removed from them and deposited in boxes or holes in the ground to ferment. They are stirred occasionally to prevent overfermentation. When thoroughly sweated they are removed, spread upon floors or shelves and allowed to dry, whereupon they acquire the reddish tint so much desired. When thoroughly dried they are put into bags and are ready for the market.

In manufacturing plants the cocoa beans are cleaned, sorted and roasted thoroughly. The roasting process is a very delicate one, as overroasting spoils the flavor. They are then cracked, the cracked beans being sometimes known as cocoa nibs. They are afterwards ground. This reduces them to a thick, oily liquid that is run into molds and allowed to cool, and forms the familiar bars and cakes of bitter chocolate. If a sweet chocolate is desired, sugar is mixed with the mass before it is allowed to cool. If cocoa is desired, some of the oil or butter is removed before the liquid cools so as to produce a less rich mixture. Approximately one half of the fat is removed from the ground bean. After cooling, the remainder is ground and bolted, the result being cocoa, a soft, floury powder which is put up in cans for the market.

Cocoa is less rich in fat than is chocolate, and is therefore often more desirable in illness. Chocolate and cocoa, unlike tea and coffee, have a high nutritive value. The roasted beans, and likewise the bitter chocolate, contain approximately 50 per cent fat, about 18 per cent protein, 10 per cent starch and 7 per cent sugar. Like tea and coffee they also contain a stimulant and tannin. The stimulant, known as theobromine, belongs to the same group of chemical substances as does caffeine, and has approximately the same physiologic effects, though not to such a marked degree. It is thought also that the tannin in chocolate is in a less objectionable form than in tea and in coffee. Since only a small amount of cocoa or chocolate is used in making the beverage, there is only a small amount of stimulant in one cup; and the chief nutritive value of the drink lies not in the cocoa but in the amount of milk and sugar used with it. Because of the stimulating quality, however, cocoa as a beverage should be given to children in very weak form. Cocoa should not be confused with coca-cola, which is the product of a different plant and contains considerable caffeine.

MAKING COCOA

In preparing cocoa as a beverage, the easiest way is also the most satisfactory from the standpoint of the resulting product. Place the desired amount of cocoa in a saucepan and add cold water to cover. Boil over direct heat, stirring until the mixture is smooth and has begun to thicken as it boils. Add cold milk and sugar, heat until foamy and beat with an egg beater to prevent the formation of the milk "skin." Cocoa, unlike tea and coffee, may be made several hours before it is to be used, and it will improve in flavor if kept heating over hot water (as in a double boiler) until served.

COLD BEVERAGES

Cold beverages are used generally between meals in the invalid diet. They should always be thoroughly chilled and are often iced. Fruit juices may be used in their concentrated form or may be diluted with water or shaved ice. Combinations of beaten egg with fruit juices are sometimes given. Eggs may be combined with milk, sweetened and flavored for a variety of so-called eggnogs. Milk in its usual form, or as buttermilk or acidophilus milk, is the staple beverage in the invalid diet. Malted milks of various flavors may also be used. Evaporated milk shaken with fruit juices and cracked ice is useful in some cases where it is difficult for the patient to take fresh milk. Effervescing waters or ginger ale are sometimes well taken by invalids. In certain cases they are specifically ordered. Iced tea, coffee and cocoa may be used between or with meals in some conditions. The choice of beverage will depend largely upon whether it is given for its food value or merely as refreshment. In any case, a cold drink served between meals adds interest to the monotonous hours in the daily routine of the invalid.

Alcoholic Beverages

Alcohol is the product of fermentation of sugar: sugars found in such foodstuffs as fruits or sugar produced from starch by a malting process. Alcoholic beverages are of two types: those which are produced by fermentation only, such as ale, beer and most wines; and those in which the fermenting substances are distilled to yield a distillate with a higher percentage of alcohol than can be secured by fermentation only. In alcoholic beverages, the alcoholic concentrations are often increased by fortification or rectification; i.e., by the addition of alcohol or strong alcoholic distillates (neutral spirits). By such procedures the alcoholic content of wines which are not distilled may be as high as from 20 to 24 per cent.

Since Federal, and sometimes state, taxes are based on the alcoholic content, the exact amount is often stated on the label of a retail product of a given manufacturer. It may be stated as percentage of alcohol: e.g., muscatel, 20 per cent, or as "proof alcohol" content. By this latter method 50 per cent alcohol is called 100 per cent proof, and a whisky labeled "90 per cent proof" would contain 90 per cent of 50 per cent or 45 per cent alcohol. For general use the table on page 408 may be used.

For a time considerable importance was attached to the value of alcohol as a food, owing to the fact that alcohol, when burned, yields energy as heat, although it is not capable of being stored in the body as other food constituents are. For this reason it has been used quite extensively in diabetic diets as a source of heat in place of the starches and the sugars. Some physicians still prescribe it for this purpose. It is sometimes given to increase the appetite. In cases of collapse it acts as a quick restorative. Like drugs, it should never be given to patients unless it is prescribed by the physician.

In its own form, wine, and most commonly sherry or port, is used in the invalid diet. Sherry, brandy, whisky and rum are used most often as flavorings for such beverages as eggnog and fruit drinks. Beer or ale may be prescribed in certain high-calorie diets, especially when for some reason milk cannot be taken. It should be noted that these beverages compare with milk merely in caloric value.

GENERAL RULES AND RECIPES FOR BEVERAGES

Coffee

A patient who is fond of coffee will be even more critical than usual with regard to it during illness or convales-

ALCOHOLIC BEVERAGES[1]

	Average Portion	Cal. per Portion	Alcohol per cent	Carb. per cent	Range of Alcohol per cent
DISTILLED LIQUORS					
Benedictine	20 cc.	80	42	30	35–50
Crème de menthe	20 cc.	74	36	30	35–50
Brandies	20 cc.	65	45	Sugar sometimes added	35–50
Rum	50 cc.	153	44	....	40–50
Whiskies	50 cc.	145	42	....	40–58
Gin	50 cc.	140	40	....	35–50
WINES					
Champagne	135 cc.	112	10	1–4	9–12
Red	120 cc.	95	12	....	10–16
White	120 cc.	89	12	....	10–16
Port	30 cc.	45	17	3–5	15–20
Sherry	30 cc.	42	17	3	15–22
MALT LIQUORS					
Ale	250 cc.	155	6	5	3–6
Beer	250 cc.	90	4	1	3–8
CIDER					
Sweet	250 cc.	70	1	5	1–6
Fermented	250 cc.	130	5	0–13	1–6

cence. The use of fresh coffee is important (see p. 402), as is the "grind," which should be suited to the type of pot. If possible, a small drip pot should be used to make coffee, especially for the invalid's tray. A proportion of two level tablespoons to three quarters of an 8-ounce measuring cup of water is now the accepted proportion. For certain heavier types of coffee, the proportion of water may be increased to 1 cup. A patient may prefer a brew weaker than this. The fineness of the grind also affects the strength of the coffee. A medium grind is usually chosen for the boiling and the percolating methods of coffee making, while a finer grind labeled "Drip Grind" should be used for drip and vacuum pots. For after-dinner coffee a double measurement of coffee is generally used.

Boiling. Pour freshly boiling water on the coffee and let it come to the boil. Settle with a little cold water, and set aside to steep for two or three minutes. Broken egg shells may be mixed with the ground coffee before water is added.

Percolating. Pour freshly boiling water over coffee after it has been put in basket. Set over heat, let boil several minutes after beverage begins to bubble in the glass top. Do not over-percolate. Remove basket containing grounds.

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[1] The above table is compiled from a number of authentic sources. There are, of course, differences in composition of various brands, as indicated by the range of alcohol. When it was possible to obtain more than one analysis, average figures were used.

Drip Method. Heat pot by rinsing with boiling water, or by allowing the separate sections, including cover, to heat round utensil in which water is being brought to the boil. Adjust basket over lower section and measure coffee into it. Adjust upper section of pot and add measured amount of boiling water. Set in warm place or place in a shallow pan containing boiling water. When beverage has finished dripping, remove upper sections and recover lower pot.

Vacuum Method. Boil water in lower portion of coffee "machine." After water boils, adjust upper sections and add coffee. Continue boiling and when water rises into upper section, stir thirty seconds, first in one direction and then in the other. Remove pot from heat but keep in warm place until beverage has all returned to lower pot. Remove upper section. If the coffee maker demands the use of a filter cloth, wash and keep under water when not in use.

Care of Coffeepots. Rinse well immediately after use and wash in hot soapy water. Scrub spout with brush. Rinse with hot water and dry. Wash metal pots so well that no coffee odor remains. Dark stains on the inside indicate that the pot was not thoroughly cleaned each time after being used.

Decaffeinated Coffee

Procedure: Decaffeinated coffee almost caffeine-free is available in vacuum cans, and may be prepared by any of the foregoing methods.

Instant Coffee

Procedure: Soluble powdered coffee dissolves instantly in boiling water, and is usually prepared by the cup, which should be heated before the coffee and the boiling water are poured into it. A caffeine-free powdered coffee is also available.

Iced Coffee

Procedure: Prepare coffee by any of the above methods, using a double proportion of coffee to water, then pour over chopped ice in a tall glass. Add more ice if necessary, and serve at once with powdered sugar and plain or whipped cream.

TEA

Tea

Procedure: The proportion of 1 teaspoon of tea or 1 tea ball to 1 cup water is generally used.

Heat the teapot by pouring boiling water into it a few minutes before it is needed. Empty, and put tea into the pot. Pour boiling water over it and let stand from 3 to 5 minutes, then serve with lemon, sugar and cream or milk, as preferred. A covered pot of boiling water should always be served with the pot of tea on the tray in order that it may be diluted if weak tea is preferred. As a variation, tea may occasionally be served Russian style in a tall glass garnished with sliced lemon.

Iced Tea

Procedure: Follow directions for making tea, using 2 teaspoons tea to each cup boiling water. After tea has steeped, pour over chopped ice in a tall glass. Add more ice if necessary, and serve at once, with quartered lemon and powdered sugar. The glass may be filled to half its depth with tea, to which, after it has chilled, ginger ale may be added.

COCOA AND CHOCOLATE

Cocoa

Ingredients:

2 teaspoons cocoa
⅓ cup cold water
¾ cup milk
2 teaspoons sugar

Procedure: Mix cocoa and water, stir over low heat until smooth. Boil 1 minute. Add milk and sugar, heat and beat until foamy with a rotary egg beater to prevent the formation of a scum. If preferred, 2–3 tablespoons cocoa sirup (see below) may be stirred into 1 cup hot milk. Serve with whipped cream. Yield: 1 serving.

Chocolate

Procedure: Follow directions for cocoa, substituting ½ square unsweetened chocolate cut in small pieces for the cocoa.

Iced Chocolate or Cocoa

Procedure: Follow directions for cocoa or chocolate and cool. Pour over chopped ice in tall glass and serve with whipped cream.

Iced Mocha

Procedure: Combine equal parts of iced coffee and iced chocolate. Flavor with vanilla extract or powdered cinnamon to taste. Serve in tall glass with whipped cream.

Cocoa Sirup

Ingredients:

½ cup cocoa
1 cup cold water
1 cup sugar
⅛ teaspoon salt
½ teaspoon vanilla extract

Procedure: Mix cocoa and water in 1½-quart saucepan and stir over low heat until mixture thickens and boils. Add sugar and salt, stir until dissolved. Boil 3 minutes, add vanilla extract, pour into pint jar and seal. After opening, store in refrigerator. This sirup will keep indefinitely, and may be used as a flavoring for milk drinks or as a sauce for puddings and ice creams. Yield: 1 pint.

MILK AND EGG BEVERAGES

Eggnog

Ingredients:

1 egg
Salt
1 tablespoon powdered sugar
¾ cup milk
1 tablespoon brandy

Procedure: Beat egg thoroughly. Add salt and sugar and beat until dissolved. Stir in milk and add brandy. Serve in glass and sprinkle with nutmeg if desired. The egg white may be beaten separately, if desired, and folded in just before the eggnog is served. Yield: 1 serving.

Chocolate Eggnog

Procedure: Follow directions for eggnog (see above) substituting 1 tablespoon cocoa sirup (above) and ⅛ teaspoon vanilla extract for brandy.

Orange Eggnog

Ingredients:

1 egg yolk
2 teaspoons sugar
½ cup orange juice
1 teaspoon lemon juice
1 tablespoon cream
1 egg white

Procedure: Beat egg yolk until foamy and stir in half the sugar. Add orange juice and lemon juice slowly, then cream. Beat egg white until stiff, add remaining sugar and fold into first mixture. Yield: 1 serving.

Malted Milk, Hot

Ingredients:

4 tablespoons malted milk
¾ cup hot water

Procedure: Moisten malted milk with enough hot water to make a smooth paste, then add remaining water gradually, stirring constantly. A little salt or celery salt may be added as seasoning, or 2 teaspoons sugar and a few drops of vanilla extract may be added as a flavoring. Yield: 1 serving.

Chocolate Malted Milk

Ingredients:

2 tablespoons malted milk
1 cup milk
1 tablespoon cocoa sirup
2 tablespoons cream

Procedure: Mix malted milk and sirup, stir in milk gradually, add cream and beat with a rotary egg beater until well blended. Pour over chopped ice in tall glass. Yield: 1 serving.

Milk Punch

Ingredients:

¾ cup milk
1 egg yolk
1 tablespoon sugar
Dash nutmeg and cinnamon
1½ tablespoons rum

Procedure: Scald milk over hot water. Beat egg yolk and sugar together, gradually add hot milk, stirring constantly. Add spices and rum and serve at once. Yield: 1 serving.

Milk Shake

Ingredients:

2 tablespoons sugar
1 cup milk
½ teaspoon vanilla

Procedure: Mix sugar, milk and vanilla in a shaker or glass fruit jar. Add shaved ice. Fasten cover tight and shake well. When milk is frothy, strain into tall glass and serve at once. Yield: 1 serving.

Banana Milk Shake

Ingredients:

1 fully ripe banana
1 cup cold milk

Procedure: Slice banana into bowl and beat well with fork or rotary egg beater until smooth and creamy. Add cold milk and mix thoroughly or shake. Yield: 1 large-size drink or 2 medium-size drinks.

Banana Milk Shake, Frosted

Procedure: Follow directions for banana milk shake (see above), adding 3 tablespoons vanilla ice cream before serving.

Fruit Beverages

Orange juice in its own form is the favorite fruit beverage. Fresh grapefruit juice is sometimes used. For preparation see Chapter 41, page 447.

Orangeade

Ingredients:

1 tablespoon sugar
¾ cup water
½ cup orange juice
1 tablespoon lemon juice

Procedure: Mix sugar and water in a small saucepan, stir over low heat until sugar dissolves. Boil 1 minute and chill. Add fruit juices, pour over cracked ice in a tall glass. Yield: 1 serving.

Lemonade

Ingredients:

1½ tablespoons sugar
1 cup water
2 tablespoons lemon juice

Procedure: Combine sugar and water, stir until dissolved. Add lemon juice, strain and pour over cracked ice in a tall glass. Yield: 1 serving.

Egg Lemonade

Ingredients:

1 egg
2 tablespoons sugar
¾ cup water
2 tablespoons lemon juice

Procedure: Beat egg and sugar together, add water and lemon juice. Strain over cracked ice in a tall glass. Yield: 1 serving.

Mint Fruitade

Ingredients:

1½ cups boiling water
¼ cup sugar
2 mint sprigs, crushed
½ cup pineapple or grapefruit juice
Juice of 1 lemon

Procedure: Boil water and sugar 3 minutes, add crushed mint. (If fresh mint is not obtainable, use 2 tablespoons dried spearmint.) Let stand from 5 to 10 minutes, strain and add fruit juices. Pour over cracked ice in a tall glass. Yield: 2 servings.

Canned Fruit Juices

Canned fruit juices can now be obtained in great variety and are useful

FIG. 79. Banana milk shake.

Fig. 80. Tomato juice may be chosen as a breakfast fruit or it may be served between meals.

in the diet of the invalid. They may be served separately, or two or more may be combined. Suggested combinations are: Pineapple and grapefruit; fresh orange juice and canned grapefruit juice; grape and fresh lemon or orange juice; prune with fresh lemon juice. Fruit juices, such as peach, apricot and pear, which are known as nectars, and tomato juice may be served separately or with fresh lemon juice. Cans of fruit juice should be kept in the refrigerator so that they may be chilled and served without ice.

WINE BEVERAGES

Mulled Wine

Ingredients:

1 1-inch stick cinnamon
3 cloves
1 tablespoon sugar
½ cup boiling water
½ cup white or red wine

Procedure: Combine cinnamon, cloves, sugar and water in a small saucepan and boil 2 minutes; strain. Add hot mixture gradually to wine and heat. Serve hot. Yield: 1 serving.

Wine Cooler

Place ¼ cup white wine in tall glass. Add cracked ice and fill glass almost to top with carbonated water. Garnish with sprigs of fresh mint or with fresh berries or seeded sweet cherries. Yield: 1 serving.

HIGH CALORIC BEVERAGES

A simple method of increasing calorie content of beverages made from a milk base is to replace fresh milk by evaporated milk. These beverages should be flavored with a chocolate sirup or with a fruit juice of distinct flavor. Mashed banana may also be combined with evaporated milk. The flavored milk may be shaken with cracked ice in a shaker or in a tightly covered fruit jar. If an electric blender is available, any fresh, canned or soaked dried fruit may be combined with milk. Vegetables such as carrots, spinach and celery may be combined with fruit juices and milk. Another pleasant and easy method of increasing calories is to add a ball of ice cream to any milk or fruit drink.

High Caloric Chocolate Milk Shake

Ingredients:

4 tablespoons lactose
4 tablespoons water
1½ tablespoons cocoa sirup (page 410)
1 tablespoon heavy cream
½ cup milk

Procedure: Mix lactose and water, heat until well dissolved. Cool and add sirup, cream and milk. Beat with rotary egg beater until slightly foamy. Yield: 1 serving.

High Caloric Eggnog

Ingredients:

3 tablespoons lactose
3 tablespoons water
1 egg
½ cup milk
2 tablespoons cream
½ teaspoon vanilla

Procedure: Heat lactose and water to boiling. Cool. Beat egg and add lactose sirup, milk, cream and vanilla. Mix thoroughly, chill and serve. Yield: 1 serving.

High Caloric Fruitade

Ingredients:

6 tablespoons lactose
6 tablespoons water
1 tablespoon sugar
1 tablespoon lemon juice
⅔ cup orange juice or pineapple juice

Procedure: Heat lactose and water to boiling. Cool. Add sugar and fruit juices. Strain over cracked ice in a tall glass. Yield: 1 serving.

Ginger Ale Ice Cream Soda

Ingredients:

¼ cup vanilla ice cream
1 small bottle ginger ale.

Procedure: Put ice cream in a tall glass and pour half of the ginger ale over it. Stir until well mixed, then add the remainder of the ginger ale. Serve at once. Yield: 1 serving.

HIGH PROTEIN BEVERAGES

The protein content of milk and egg beverages may be increased by several methods:

1. Substitute undiluted evaporated milk for the milk measurement in any recipe.

2. Substitute dry milk in the proportion of ⅓ cup to 1 cup water or milk for milk measurement in any recipe. Flavor according to suggestions in High Caloric Beverages. To reconstitute dry milk, place water in bowl, sprinkle dry milk on top and beat with rotary egg beater until completely blended.

3. Use 2 eggs instead of 1 in recipes which call for eggs, or add 1 well-beaten egg to any cold beverage made with milk.

4. Use protein hydrolysates according to the directions which accompany the individual products. A list of some of these available at present follows:

Amigen—Meade, Johnson & Co., Evansville, Ind.
Aminoids—Arlington Chemical Co., Yonkers, N. Y.
Casec—Meade, Johnson & Co., Evansville, Ind.
Delcos Granules—Sharp & Dohme, Philadelphia 1, Pa.
Essenamine—Frederick Stearns & Co., Detroit, Mich.
Nutragest—Burroughs, Welcome & Co., New York City.

Skim-milk Casec Feeding

Ingredients:

1 quart skim milk
1½ cups Casec
1 egg, whole
10 egg whites
8 tablespoons lactose
11½ tablespoons sugar

Procedure: Add milk slowly to Casec to make a smooth paste. Add the rest of the milk. Beat in the eggs and the sugars. Add vanilla or other flavoring as desired.

High Protein Milk

Ingredients:

2⅔ cups milk
1 cup and 9 tablespoons dry milk powder
5 egg whites
2 tablespoons sugar

Procedure: Add milk to the powder to make a smooth paste. Beat in egg whites and sugar. Chocolate sirup or vanilla may be added to taste.

Ice Cream Feeding

Ingredients:

1 pint milk
2 eggs, whole
12 tablespoons Casec
1 pint ice cream
1 teaspoon vanilla

Procedure: Add milk to Casec to make a smooth paste. Beat in eggs. Add ice cream and flavoring and mix well. Add chocolate flavoring to taste.

High Caloric High Protein Feeding

Ingredients:

6 eggs, whole
1 pint milk
1 pint ice cream
10 tablespoons skim-milk powder
4 tablespoons lactose
3 tablespoons Casec
4 teaspoons chocolate sirup

Procedure: Mix lactose, Casec and skim-milk powder and add milk to make a smooth paste. Beat in eggs. Add ice cream and flavoring.

High Protein Milk (Basic Recipe)

Ingredients:

4 tablespoons dried milk
2 egg whites
⅔ cups milk
1 tablespoon dextrose

Procedure: Beat egg white until stiff but not dry. Add dried milk and mix well. Combine milk and dextrose with egg-dried milk mixture. Vanilla or other flavoring should be used to taste. If fat is restricted, use dry skim milk in place of dried whole milk.

High Protein Eggnog

Ingredients:

2½ tablespoons dried milk
1 egg, whole
¾ cup milk, whole or skim
1 tablespoon dextrose or sugar

Procedure: Separate egg, beat white until stiff but not dry. Add dried milk and mix well. Beat egg yolk, add dextrose and milk. Combine the two mixtures. Flavor with vanilla and nutmeg. If fat is restricted, use dry skim milk.

High Protein Malted Milk

Ingredients:

3 tablespoons malted milk
2 egg whites
⅔ cup milk, plain or chocolate

Procedure: Beat egg white until stiff but not dry. Add malted milk powder, mix well and add milk.

Albumen Lemonade

Ingredients:

2 tablespoons lemon juice
4 teaspoons dextrose
¾ cup water
1 egg white

Procedure: Dissolve dextrose in a little hot water. Add cold water and lemon juice. Cut egg white with two knives and add to lemonade. Strain over ice.

Fruit Juice with Egg White

Ingredients:

½ cup fruit juice (tomato, orange, pineapple or grape juice, etc.)
1 egg white

Procedure: Cut egg white and add tomato juice, beating slightly. Avoid beating to a froth.

Ginger Ale, Grape Juice with Egg White

Ingredients:

¼ cup grape juice
1 tablespoon lemon juice
¾ cup ginger ale
2 egg whites

Procedure: Cut egg white with backs of two knives. Add grape juice and lemon juice. Add ginger ale when served. Chill thoroughly.

Diabetic Beverages

Saccharin may be substituted for sugar in any beverage in which the other ingredients comply in the proportion allowed on the special diet. The proportion generally used is ¼ grain saccharin tablet to 1 cup of unsweetened liquid.

REVIEW QUESTIONS

1. What beverages are preferable as accessory to a meal? Give the reasons for your choice.
2. Outline the principles of preparing coffee as a beverage.
3. What method is considered best and why?
4. Outline the principles of making tea. Give reasons for the choice of this method.
5. List beverages suitable for serving between meals as refreshment. Which of these would supply a worthwhile amount of vitamin C?
6. List beverages which may be taken for additional nourishment.
7. How may the caloric and the protein content be increased somewhat? How may the protein content be greatly increased?

38

Milk

Chapter Topics

SAFE MILK	DIGESTIBILITY
COMPOSITION OF MILK	MILK IN THE MENU
FOOD VALUE	USE OF MILK IN RECIPES

Milk, although not a perfect food, is the best single food which nature provides and the only animal food biologically intended for food. Each animal provides for its young the food adequate for its growth and its protection during infancy. Cow's milk, designed by nature for the young calf, has become the chief form of milk for human consumption, and the discussion of milk in this chapter will be limited in general to cow's milk. The adaptations which must be made in infant feeding were discussed in Part One, Chapter 16. While milk is particularly important until growth is completed, it is an asset to the diet throughout life. No other food scores so well in so many respects, and it is almost impossible to equal it by any combination of other foods. Because milk is a liquid, some adults think of it as a beverage rather than as a food and fail to recognize its importance in the daily diet.

SAFE MILK

The safety of the milk supply is as important as the safety of the water supply. Many cities and most states have set up standards for cleanliness and bacteria content. All milk must be pasteurized or comply with standards set for what is known as certified milk. Nowhere else in the world is the milk supply as uniformly good as it is in the United States. (See Chap. 14.)

In the absence of a good supply of pasteurized milk, fresh milk should be pasteurized or boiled at home, or evaporated or dry milk should be used. Evaporated and dry milk are sterilized or pasteurized in factory preparation, in the course of which they lose little of their nutritive value. Large quantities of dry milk were manufactured during World War II for shipment abroad, and the consumer will now profit from the new and efficient methods of preparation which were developed during that period. Most of the dry milk on the market is in skimmed form and sells at a low price. During manufacture, the curd of both the canned and the dry milk is broken up, and for this reason the milk is easily digested. For the same reason doctors advise that fresh milk be boiled when used for infant feeding. Sweetened condensed milk has a higher fuel value than other milk because of the large amount of sugar used in its preparation, but because of the high sugar content it is not usually prescribed by the doctor for infant or invalid.

COMPOSITION OF MILK

This liquid which we know as milk is a yellowish-white fluid which is a solution of sugar, proteins, certain minerals and vitamins with fat "held in suspension." The color is due to coloring matter which is contained in the fat and is some indication of the richness of the milk. While a certain minimum amount of fat is desirable and often designated by law, the food value of milk does not depend so much upon that as upon the quality of the proteins, the minerals and the vitamins which are present throughout the whole milk. Contrary to opinion, even skim milk is a more valuable food from the nutritive standpoint than cream. When milk is skimmed, most of the fat and of the vitamin A and a small amount of the riboflavin are removed with the cream, but it still scores high on other counts.

The milk of different breeds of cattle varies as to the amount of the total solids and of fat. The content of each may vary with the season of the year and with the feeding and the care given the animals. Market milk, however, because it is a mixture from different cows, maintains a fairly constant average.

APPROXIMATE AVERAGE COMPOSITION OF COW'S MILK

	Per Cent
Protein	3.5
Fat	3.9
Sugar	4.9
Minerals	0.7
Water	87.0

State standards usually take into account both the fat content and the total solids. The requirements in general range from 2.5 per cent to 3.5 per cent for fat content and from 11.5 per cent to 12 per cent for total solids. Most market milk is well above the minimum.

FOOD VALUE

The test of the nutritive value of a food lies in its ability to satisfy the needs of the body.

In nutritive value milk stands high. For fuel purposes average milk gives 660 calories a quart. A two-year-old child needs about 1,200 calories; and the quart of milk which he must have to get the other dietary essentials will give him half the calories that he needs. The fat and the sugar, which with the protein furnish the milk calories, are present in forms which are very easily digested. The sugar is in the form of lactose, which does not ferment readily or cause digestive upsets, and it also aids in preventing the growth of the putrefactive bacteria which develop in the intestines and which sometimes cause digestive disturbances.

The quality of the protein in milk is excellent, which means that it contains the amino acids needed to build new tissue. This is invaluable when it is realized how much new tissue a child must build each year until he arrives at maturity. In the first year a baby triples his weight; and although his rate of growth is less than this as he grows older, he must continue to gain a number of pounds each year. Although diluted cow's milk which is used in infant feeding does not contain exactly the same quantity and types of amino acids as human milk, research reported by

Williamson[1] shows that the differences are not significant. The quart of milk which the two-year-old takes will furnish him with enough protein of the best kind. Older children will get more of their protein from other sources. Adults may get some of the amount they need from milk as well as from other sources. It is also important to note that the protein in milk will supplement that of the cereals, and in this way give these economical foods a higher value.

The mineral substances found in milk are important. The trace of iron present is easily available. Calcium and phosphorus, necessary factors in forming bone, are furnished in large amounts by milk, on which children depend for an adequate supply during the time that the framework of their bodies is being built. A lack of either mineral may cause rickets.

In a series of experiments with children from three to thirteen years of age, carried out by Columbia University, one quart of milk produced optimum storage of calcium. It was observed that even when supplemented with calcium from vegetables, a pint of milk did not produce the same results. Daniels, however, reports that optimum storage has been obtained on a pint of milk, but only when the children studied were already in good physiologic condition.

Milk is relatively rich in vitamin A and contributes enough thiamine to make it valuable in a diet where it is used liberally. The riboflavin content

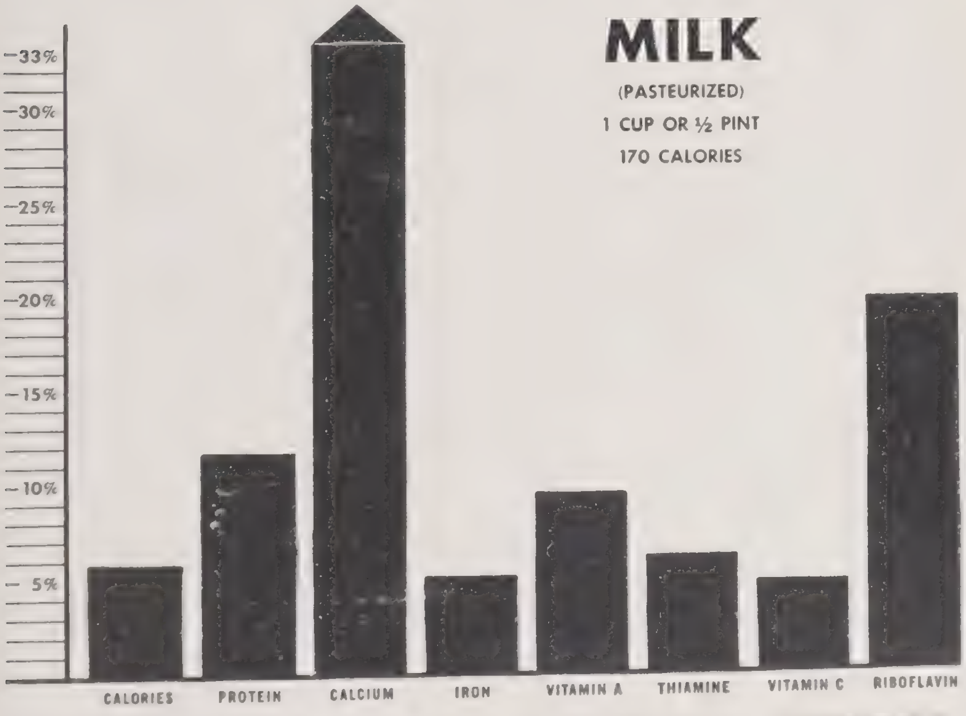

Fig. 81.

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[1] Williamson, J.: Biol. Chem. **156**:47, 1944.

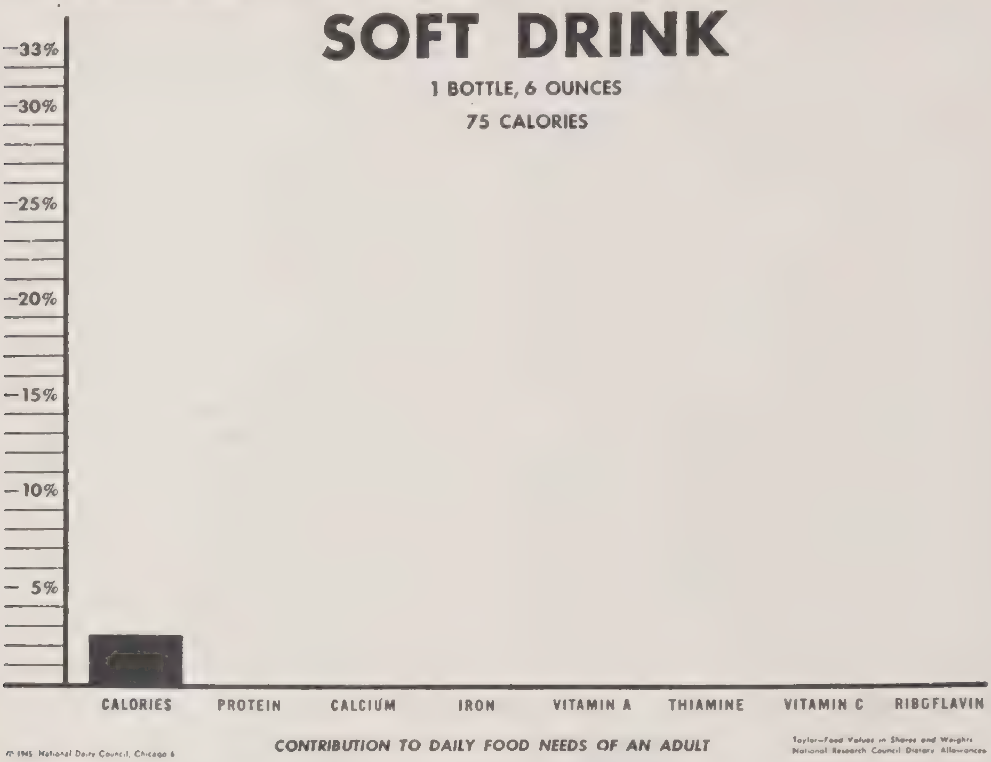


Fig. 82.

ranks with that of cooked meats, the main source of this factor to the diet. Milk also contributes certain amounts of niacin. The vitamin C content is low and is probably influenced by the period of storage. As milk is such an uncertain source of this vitamin, it cannot be counted upon as a major source of supply.

The vitamin D in natural milk is not sufficient to protect children against rickets, which results in the absence of a liberal amount of this factor. It has, however, become a common practice to reinforce both fresh and evaporated milk with vitamin D. Three different methods are used for this purpose: "Irradiated" milk is that which has been exposed directly to ultraviolet light rays from a carbon arc; "metabolized" milk is produced by feeding the cows irradiated yeast; "fortified" milk is that to which a vitamin D concentrate has been added, and it is now more generally distributed than the other types of reinforced milk. If milk is compared with other foods, the conclusion will be drawn that no other food provides a better selection of nutrients.

Cream has a fat content of from 18 to 40 per cent, depending upon whether it is sold as "light" coffee cream or "heavy" whipping cream. As the fat increases, most of the other nutrients decrease. It is used generally for flavor. Whipped cream, when used as a garnish, contrasts favorably with the flavor and the texture of the dessert or soup with which it is served. Comparing food value with cost, it is much more expensive than milk. In the high caloric diet it may be useful if the fat is well tolerated.

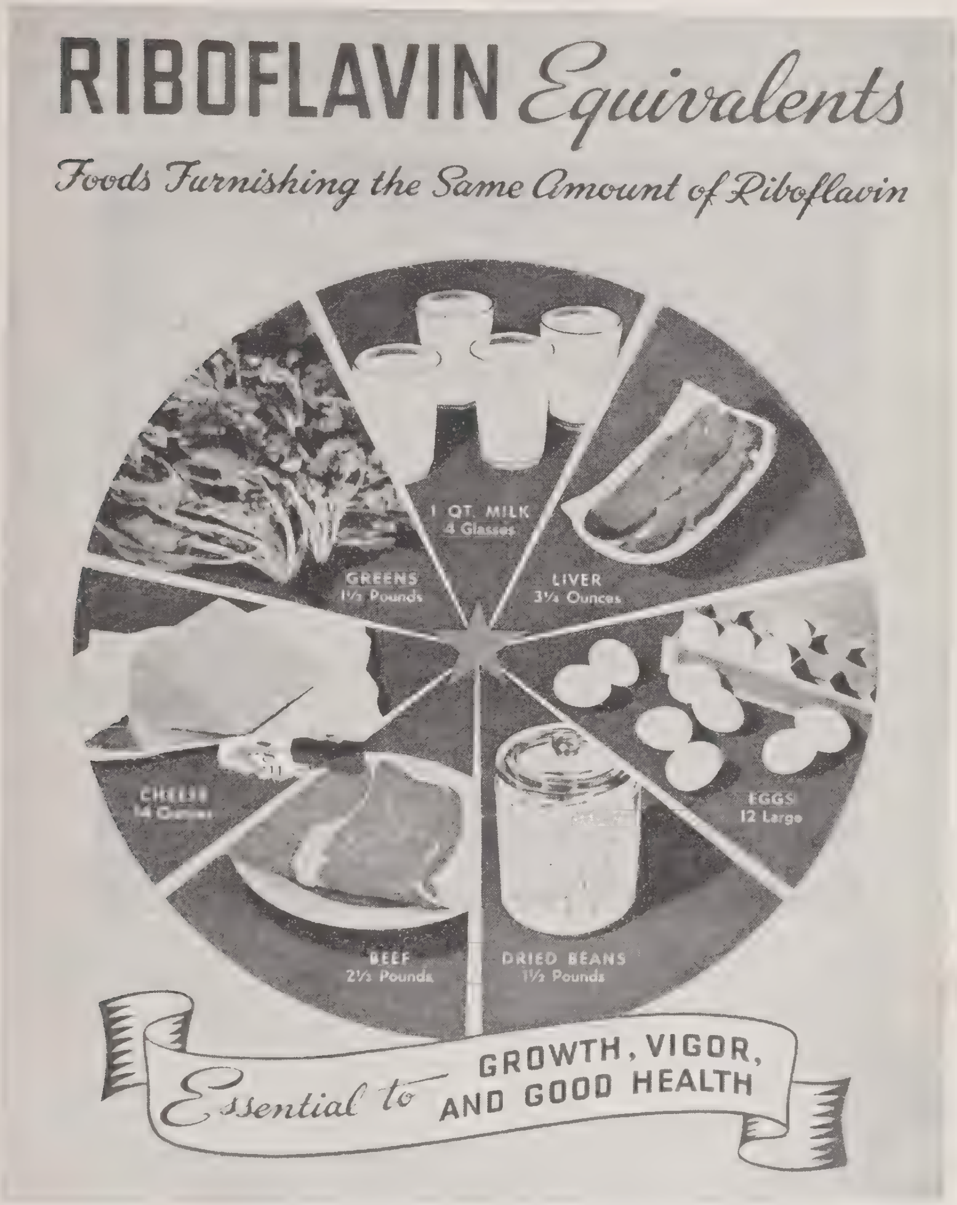


Fig. 83. (National Dairy Council.)

DIGESTIBILITY

Because milk has a high food value and is so easily digested, it is usually an important factor in the diet of the sick. It may often be prescribed for persons who have been unable, or who have thought they were unable, to take it as a beverage. Sometimes because it is "doctor's orders," a patient will give milk a fair trial and find he is able to digest this liquid food. Homogenized milk, prepared by a process which reduces the size of the fat globules and makes a more perfect emulsion, is often tolerated better than regular milk.

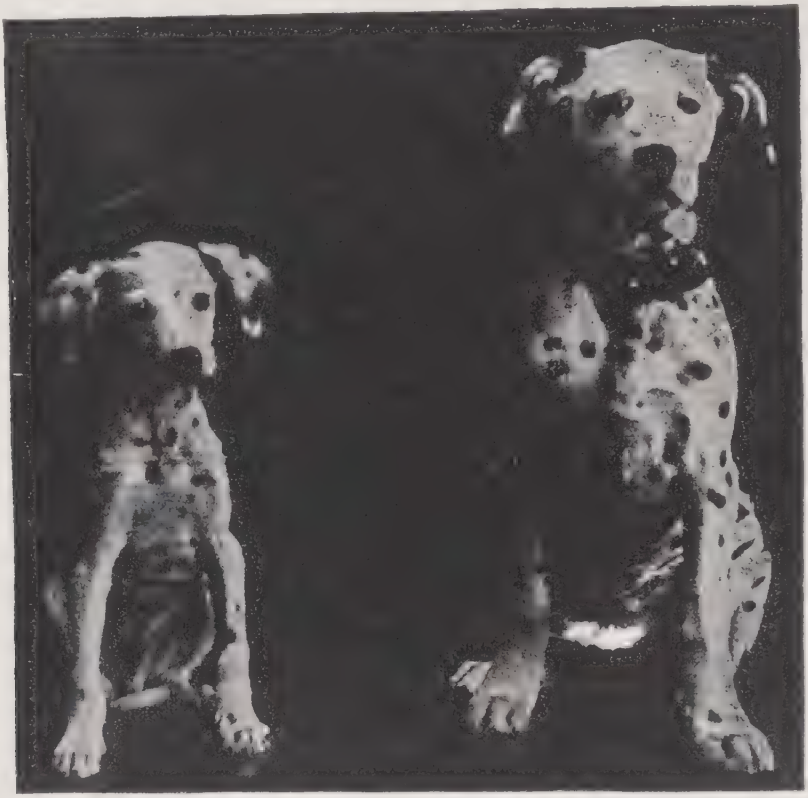


Fig. 84. Two puppies of the same age. The larger one had an abundant supply of milk; the smaller one had little milk but plenty of other food. (The Shattuck Farms, Andover, Mass.)

It may sometimes be necessary to prepare milk specially: for example, to boil it, which makes a smaller curd for digestion, or to mix it with carbonated waters. In some cases evaporated milk drinks flavored with orange juice or cocoa will be taken more easily than fresh milk because of the difference in flavor and in texture. In other cases in which liquid milks are unsuccessful, dried milk may be mixed with other foods such as sandwich fillings.

Other products which can sometimes be used successfully are yogurt and junket. In the former the milk is thickened by the use of the acidophilous culture, and in the latter it is set by the use of rennet. Still other milk products which may be found useful are cream and cottage cheese.

MILK IN THE MENU

Milk a Necessity. It is not hard to convince the majority of people that children must have milk in their diet, although too few children receive an adequate allowance per day. It is not so easy to persuade adults that they too need milk. As adults usually obtain an adequate supply of protein from other foods, the great value of milk to them lies in its other protective qualities, minerals and vitamins.

Objections to Milk. There are two objections to the use of milk by uninformed persons: that it is constipating and that it is fattening. The first objection may be met by encouraging the use of more laxative foods; the second by suggesting that a glass of milk be taken instead of a second slice of bread or a second helping of dessert. In a reducing diet it is important that some milk be included, as when the amount and the variety of food are cut down, special care must be taken to supply the minerals and the vitamins.

How Milk May Be Taken. Milk may be taken in the form of custards, soups, cocoa and other milk dishes, for, fortunately, milk in such forms is just as nutritious as when taken as a beverage and often it is more easily utilized. When a specific sensitivity to milk exists it may have to be omitted, but in that case special care should be taken to keep the diet adequate. Sometimes milk in canned or dried form or boiled fresh milk can be taken by those who are allergic to fresh milk. It should also be noted that milk in canned and in dried form is convenient and economical for use in general cookery.

Summation of Value of Milk. The value of milk in the diet of the family may be summed up as follows:

Milk contains more food essentials in better proportions than most other foods.

Milk is an excellent source of both calcium and phosphorus.

Though milk contains only a small amount of iron, that amount is in an easily available form.

Milk proteins are of the best quality for tissue growth and repair, and are especially valuable as a supplement to the incomplete proteins of grains.

The fat of milk is in an emulsified form and is easily digested.

The only carbohydrate in milk—lactose—is available as a fuel food. It increases calcium absorption from the intestine and inhibits putrefaction in the colon.

Milk is a good source of vitamin A and riboflavin, and contributes thiamine. It is also an excellent carrier of vitamin D when reinforced.

Milk should be considered a necessity, not a luxury, because it furnishes more of the protective food factors for the money than any other food.

USE OF MILK IN RECIPES

Milk is an ingredient in innumerable recipes, such as those classified under Beverages, Desserts and Soups and in other chapters. When used either by itself as a beverage, or as an ingredient of a cold beverage, it is usually desirable to have it chilled. When it is to be served hot, either by itself or as an ingredient, general practice is to place it in the top of a double boiler and heat over hot water. This prevents scorching, which injures flavor. Even in a double boiler, milk should not be overheated, as this causes the formation of scum. If scum forms, it may be beaten into the milk with a rotary egg beater.

REVIEW QUESTIONS

1. Why is milk considered an almost perfect food? Compare the contributions of ½ pint milk with those of a 6-ounce bottle of a soft drink.
2. The importance of a safe milk supply is recognized. What forms of milk are safe to use?
3. Discuss the digestibility of milk. If it is not well taken in fresh form, how may this difficulty be overcome?
4. Outline the reasons for use of milk in the family diet.
5. List ten recipes in which a large amount of milk is called for.

39

Fats, Sweetenings, Seasonings and Flavorings

Chapter Topics

FATS

SWEETENINGS

SEASONINGS AND FLAVORINGS

Fats, sweetenings, seasonings and flavorings are grouped together in this chapter because of their importance in cookery and their contributions to the preparation of good meals. When they are used in combination with other ingredients, they have one or more functions, the most important perhaps being the property which they all share of tying together other foods so that texture or flavor, or both, may be interesting. All these products are used as ingredients in recipes, and some of them have a place on the table as accessories to other foods. Among fats, for instance, butter and margarine have a large use as spreads for bread, when their function is somewhat the same as when fat is used as an ingredient of a recipe. Sugar, honey and sirup among sweetenings and salt and pepper among seasonings have common use as accessories at meals.

From the standpoint of nutrition, fats, sugar and other sweetenings which have a high fuel value differ completely from the majority of seasonings and flavorings which seldom have any nutritive value. The individual contributions of all these assets to food preparation will, therefore, be discussed under separate headings.

FATS

For their weight, fats have the highest fuel value of any food. They are concentrated sources of fuel and energy. Butter and fortified margarine differ from other fats in that they supply valuable amounts of vitamin A which most fats and oils lack.

Fats are classified roughly as hard or hardened fats, which include table spreads and shortenings, and as liquid fats, which are known as oils and have their largest use for frying and as an ingredient of salad dressings. With the exception of butter, margarine and olive oil, fats are generally bland in flavor. These bland fats are generally less expensive than those with flavor, and it is economical to make use of them in recipes when other ingredients provide the appetite appeal.

All hard fats, including butter, margarine, lard and hardened vegetable fats, share a characteristic known as shortening power which influences the texture of baked products such as muffins, biscuits, cakes and pastry. Oils have a small use as shortening, but generally they are not as satisfactory for this purpose as are the hard fats.

VITAMIN A POTENCY OF CREAMERY BUTTER PRODUCED DURING THE WINTER AND THE SUMMER MONTHS IN 14 STATES

Region and Participating State	Average Yearly Butter Production			Average Vitamin A Potency per Pound		
	Total	Winter Months	Summer Months	Winter Butter	Summer Butter	Annual
	Million pounds	*Per Cent*	*Per Cent*	*International Units*	*International Units*	*International Units*
North Central:						
Minn.	304.4	43.3	56.7	10,808	17,946	14,855
Wis.	151.2	34.6	65.4	10,663	18,884	16,039
Ohio	69.5	31.4	68.6	9,698	15,459	13,650
Iowa	241.0	37.4	62.6	10,946	17,434	15,010
Neb.	93.3	36.5	63.5	11,287	20,667	17,030
Kan.	74.7	37.8	62.2	11,606	15,030	13,768
Total or average	934.1	38.3	61.7	10,863 ± 267	17,810 ± 870	15,150 ± 535
South Atlantic and South Central:						
N. C.	1.8	29.5	70.5	9,674	16,253	14,312
La.	.8	29.2	70.8	12,283	18,068	16,379
Miss.	4.0	22.8	77.2	12,014	17,868	16,533
Total or average	6.6	25.4	74.6	11,301	17,471	15,903
Rocky Mountain and Pacific Coast:						
Wash.	32.0	17.8	82.2	12,162	19,827	18,467
Ore.	28.2	34.7	65.3	12,899	18,464	16,535
Calif.	43.2	19.0	81.0	15,140	18,968	18,241
Idaho	37.1	37.1	62.9	13,312	18,197	16,384
Mont.	12.7	29.7	70.3	18,636	22,018	21,014
Total or average	153.2	26.9	73.1	13,931	19,170	17,754
Grand total or average	1,093.9	35.7	64.3	11,160	17,955	15,529

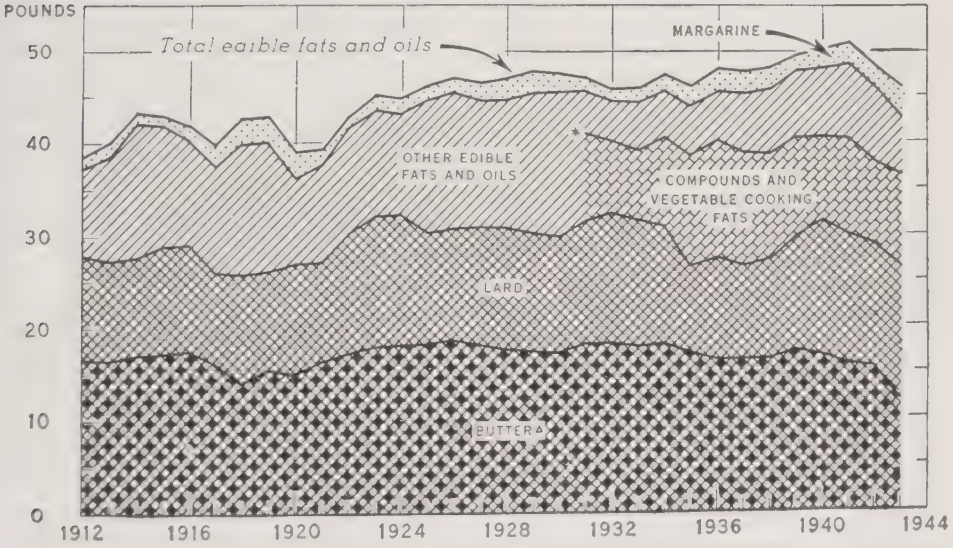
All types of fat are used for frying, but only liquid fats known as oils are used in the preparation of salad dressings. The distinctive flavor of olive oil gives it preference for use in salad dressings, unless of course this flavor is disliked. Bland oils, which may be a product of corn, cottonseed, peanuts or soybeans, especially the first two, are more largely used than olive oil for dressings.

BUTTER

Butter is made from milk fat which is known as cream. As some moisture and curd remain after the cream is churned, butter generally contains about 85 per cent fat. This gives it a very high fuel value—about 3,500 calories to the pound. Fat is digested less quickly than protein or carbohydrate and thus gives satiety value to a meal. Butter may have added advantages in certain pathologic conditions—hyperacidity, for instance—because of its nonstimulating and even soothing effect. In some types of maladies there may be a low toleration of fat, but in general butter in moderate amount is well taken.

In addition to its fuel value, butter is an excellent source of vitamin A and may contain some vitamin D. These vitamins are retained with the fat when it is removed from the milk. It has long been known that the vitamin A content may differ under summer and winter feeding conditions of the cows which produce the milk from which it is made. A recent survey made by the Bureau of Dairy Industry of the United States Department of Agriculture in regard to the vitamin A potency of about 64 per

PER CAPITA CIVILIAN CONSUMPTION OF EDIBLE FATS AND OILS, UNITED STATES, 1912-43



* BREAKDOWN BETWEEN COMPOUNDS AND VEGETABLE COOKING FATS AND OTHER EDIBLE FATS AND OILS NOT AVAILABLE PRIOR TO 1931

▲ ACTUAL WEIGHT OF BUTTER, FAT CONTENT OF OTHER FATS AND OILS PRODUCTS

DATA FOR 1943 ARE PRELIMINARY

U. S. DEPARTMENT OF AGRICULTURE NEG. 43581 BUREAU OF AGRICULTURAL ECONOMICS

FIG. 85.

cent of the creamery butter produced in the United States shows that this may vary from approximately 11,200 to 18,000 international units per pound. The study indicates that the average vitamin potency of the total output of creamery butter is 15,000 international units per pound. The effect upon the vitamin A content of storage and handling has been found to be negligible.

The quality of butter, of which flavor is the common test, has improved greatly under modern conditions of production and handling. It has become the favorite spread and a shortening for fine foods. For this reason it is wise to use it on the invalid's tray when obtainable.

Margarine

Margarine is the term used to cover shortenings which most nearly approximate butter in consistency and in flavor. The quality of margarine has improved enormously in the last decade. During butter rationing and shortage, many persons became acquainted with margarine for use as a table spread, and learned that good margarine was very satisfactory for use in this fashion as well as for shortening. Federal and varying state laws with regard to the taxing of this product and its distribution prevent as wide a use of it as is desirable, especially in the case of low-income groups.

Results of experiments conducted to show the comparative nutritive value of butter and fortified margarine failed to show any significant differences when they were used in a mixed diet. The fuel value is equal to that of butter. While margarines are almost entirely lacking in natural vitamin content, most of them are now fortified with 15,000 international units vitamin A per pound.

SWEETENINGS

Sweetenings rank next to fat with regard to their caloric content per unit of weight. All sweetenings have a more or less concentrated caloric value in ratio to their concentration. This is highest in sugar and lowest in cane sirup or sorghum. White sugar, which is highly refined, contributes only calories. Brown sugar, maple sugar and sirup, corn sirup and honey have a very small mineral content, but molasses is considered a good source of minerals, particularly iron. Honey and molasses both contribute small and varying amounts of the vitamins of the B complex.

In order of volume the sweetenings used in food preparation and as table accessories are sugar, molasses, corn sirup, cane sirup, honey, maple sirup and sugar. Of these, honey has perhaps the oldest history; except for the Frigid Zones, its production is worldwide. Sap from the maple tree in regions where it is indigenous also has a long history, dating from the time when it was discovered that the trees could be tapped and the sap concentrated by boiling. The juice of the sugar cane also had some use at an early date, but it is only within the last few centuries that methods were developed for producing sugar in the many forms in which we know it today. It is only in comparatively modern times that the sugar beet has become a source of the world's sugar supply. It is a still shorter time since methods of extracting sweetening from corn to produce a thick sirup were evolved. A small amount of corn sugar is also produced, most of it for commercial use. Some use of dextrose, a form of corn sugar, is made in the invalid diet when it is desirable to increase caloric value without oversweetening a beverage or a dessert.

Sugar has become the staple sweetening since the large volume of production has made it less expensive than other forms of sweetening. More sugar from cane than from beets is used in the United States. Both types have the same sweetening power. Most recipes which call for sugar indicate the granulated form, although brown sugar is used to some extent. Both granulated and tablet sugar are used for sweetening coffee and tea. Powdered and confectioners' sugar, both fine in texture, have some use in cookery and on the table.

Honey and all forms of sirup have some use in recipes and also as a table accessory for griddle cakes and other hot breads. There is a large use for corn sirup in preparation of the infant's formula. Molasses is less used at the present time as a spread than as an ingredient in cooking.

All sweetenings have the power of satisfying appetite. This may be an asset or a liability, depending upon how they are used in the diet. The custom of serving a dessert has proven good, as it provides the final satisfaction to a meal. On the other hand, sweets should not be eaten to any extent between meals, as they may spoil the appetite for the following meal. For this reason, it is recommended that candy, the most concentrated of sweets, be taken after meals. Dried fruits, in which the natural sugar has become concentrated, are also classified as confections, although they are far less sweet than candy.

The reduced amount of sugar available during and after World War II has brought a realization of the flavor and the satisfying power of sugar which was previously lacking. Through the necessary reduction of sugar in many recipes, some people have developed a taste for less. This may be an advantage if weight must be watched or if sweets have had too predominant a place in the diet.

SEASONINGS AND FLAVORINGS

There is no cut and dried distinction between the terms seasoning and flavoring. As generally applied, salt, pepper, herbs and certain spices are considered seasonings, as are such highly flavored foods as onions, cheese and tomatoes. The word flavoring generally is used to describe extracts of vanilla, almond, lemon, etc., fresh fruit juices and chocolate and coffee which are combined with a sweetening. Certain spices also belong in this category.

Salt, for which man has a justifiable craving, has the most important place among seasonings. The search for it began as soon as vegetable foods necessarily began to replace a meat diet which satisfied the needs of the body in this respect. The first trading posts are believed to have originated at points where representatives of tribes met to exchange hides and furs for the precious commodity. Salt was valued not only for its seasoning power but for the part it played in the preservation of meat and fish. It remains today a household staple and is used to season almost every dish. The right amount of salt adds the necessary savor, although care should be taken not to use it so generously that the natural flavor of foods is injured. Also, tastes differ with regard to the amount of this seasoning, and for this reason it is better to undersalt than to oversalt a dish.

When the diet must be salt-free or salt-low, it is important to make good use of other seasonings. Dishes may be made palatable if the seasonings and the herbs which must be used for flavor are properly blended. Ammonium chloride cooked with food adds some flavor and can be used when sodium chloride must be omitted.

Next to salt, pepper is the most common seasoning. In almost every pantry mustard, ginger, cloves, nutmeg and cinnamon will be found, and perhaps celery salt, curry powder, whole cloves, bay leaf, and other leaf or powdered herbs such as sage, thyme and marjoram. Among fresh herbs, parsley and chives are the most commonly used. Onions are always kept on hand, and fresh garlic or salt may be a staple seasoning. Other vegetables such as carrots and mushrooms are often used for their seasoning value. In the broad sense, meat stock and highly flavored fats such as bacon drippings, butter and olive oil may be classified as seasonings. Lemon juice, vinegar and bottled sauces such as Worcestershire and catsup are also used to add piquancy to food.

Among flavorings, vanilla extract is in most common use. This may be supplemented by extracts of innumerable flavors, by wine, brandy and rum, by fruit juices and grated orange and lemon rind, and by a variety of spices some of which are also used as seasonings.

Seasonings and flavorings used to suit the taste of the person or the family for whom food is prepared are an important factor in appetite appeal. In the convalescent diet there is a special need for careful seasoning. Sometimes bland foods are preferable, but even these need a certain amount of seasoning and flavoring to make them palatable. Highly flavored foods may cause digestive disturbances, and the condition of the patient as well as his tastes must be considered when meals are prepared for him. An intelligent use should be made of the many accessories which add to the interest of food.

REVIEW QUESTIONS

1. What properties have fats, sweetenings, seasonings and flavorings in common? In what respects may they differ?
2. How may fats be classified? Outline the specific purposes for which various types of fats are used.
3. Compare butter and margarine for food value.
4. What products are grouped under sweetenings? Which has become the staple sweetening and for what reason?
5. What seasonings and flavorings are most used? Which has the most important place and why?
6. Discuss the proper use of seasonings and flavorings.

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Cereals and Cereal Products

Chapter Topics

TYPES OF CEREALS
GENERAL COMPOSITION
FOOD VALUE
DIGESTIBILITY
PLACE IN THE MENU
PREPARATION
BREAKFAST-CEREAL RECIPES
RICE RECIPES
MACARONI AND NOODLE RECIPES

The ancient Romans called the goddess of the grains and the harvests Ceres, and it is from her name that the word cereals is derived. Because of their widespread cultivation, the comparative ease of transportation, their keeping qualities and the great variety of products which may be manufactured from them, cereals are now one of the great staples of human diet, as they were in prehistoric days, when food was used where it was grown.

In the United States, in spite of the great variety of foods available, cereals form the basis of practically every meal, as they do in most other countries. Cereal habits have changed greatly since Colonial times, when grain raised on the farm and ground at a near-by mill furnished the material for the corn-meal mush known as hasty pudding and for the journey-cakes known as johnnycake or hoecake, and for the huge loaves of yeast bread baked in the brick oven usually heated only once a week. Flour was also used for the many pies which during the winter were frozen and used as needed. In some sections of the country, doughnuts were made daily. Later, biscuits were sometimes baked in tin ovens in front of the fireplace, but muffins and fine cakes were not commonly used until a century or so ago, when the kitchen range came into use. Chapter 50 will be devoted to the use of flour in the preparation of baked products in use today. Macaroni and other products of this type made from flour were unknown, but rice was used largely in the South as a vegetable and to some extent in the North for puddings.

The Industrial Revolution brought factory methods of milling flour which produced products of better texture, although at the expense of some minerals and vitamins. Breakfast cereals, even oatmeal, with the exception of the previously mentioned corn-meal mush which was used as often for supper as for breakfast, were not part of the American diet until little more than half a century ago. Oatmeal was used principally at first for the preparation of gruels for the sick, and was sold only in drugstores. The modern treatment by cereal manufacturers of grains for breakfast use has brought such products great popularity. Most breakfast cereals are precooked at the factory, whether they are ready to eat or whether they demand some cooking in the home kitchen. The fact that these cereals are eaten generally with a generous amount of milk adds to their importance in the diet.

FIG. 86. Cereal is an accepted part of the American breakfast.

TYPES OF CEREALS

Cereals form the largest crops throughout the world, and cereal foods are present in large proportion in most diets the world over. They are well called the staff of life of every country, whether they are eaten in loaf form or as a boiled or a parched grain. Various racial groups tend to cling to the cereals to which they have been accustomed, as is illustrated by the extensive use of rice by Orientals in countries where wheat is more plentiful. The commonly used cereals have certain distinctive characteristics:

Barley is used after the germ and the bran have been removed. The first form is known as pearled barley. When this is broken up into smaller bits, "instantaneous" barley is obtained, and barley flour is made by grinding the "pearls." Barley water, made from the flour, has been used a good deal in feeding infants and the sick. It contains very little nourishment, but has a soothing influence on the mucous membrane of the digestive tract.

Buckwheat is not botanically a cereal, as it does not belong with the grasses; but it serves the same purpose in the diet. The bran is removed and the rest of the kernel is rolled and bolted.

Corn or maize contains a higher percentage of oil than any other cereal, except oats. Because of its low gluten content, it does not give a flour which can be well used in making leavened doughs. The different kinds of corn are practically the same in composition, although yellow corn has a higher vitamin A content than white corn. Corn meal, cornstarch, samp and hominy are all made from field corn. Corn meal is more generally used than other forms of this cereal.

Oat preparations vary little from the original grain. In "oatmeal," therefore, is found a concentrated and valuable cereal which scores higher in protein, fat, minerals and most vitamins than any other cereal. It loses less between the field and the table than is usually the case with the other cereals.

Rye is similar to wheat in most respects, but is not used in the United States so extensively as wheat.

Rice, the staple food of the Orient, is used as an accessory food in this country. In its brown, unrefined form, it supplies certain minerals and vitamins which are largely lacking in white rice, the refined product generally used. These are also present in wild rice, which comes from a different botanical family and which has only limited usage. A new method of processing unmilled rice known as conversion has recently been initiated. Converted rice has much the same cooking qualities and flavor as the milled rice grain. The moist heat to which it is subjected tends to drive some of the soluble B complex vitamins from the hull into the kernel, so that the B complex in the milled grain is increased.

Wheat is the cereal which is more generally used than any other in the United States. It lends itself to breadmaking better than any other grain because of its richer gluten content. It is also used in various forms for breakfast cereals. When the whole grain is used, it contributes minerals and vitamins of appreciable value in the diet. The daily use of the whole-grain bread gives an added factor of safety which is of special value where the diet is limited by lack of money or other circumstances.

Recent research in nutrition as related to economic problems indicates that unmilled cereals, if properly supplemented, may assume an even more important place in the low-cost American diet than they do at present. In the interim, white flour enriched with calcium, iron, thiamine, riboflavin and niacin is nutritionally advantageous. The improvement in nutritional health of the American people, even under rationing, is attributed to some extent to the flour- and bread-enrichment program. Its continuance will depend upon the action taken by the individual states, many of which have passed laws to this effect.

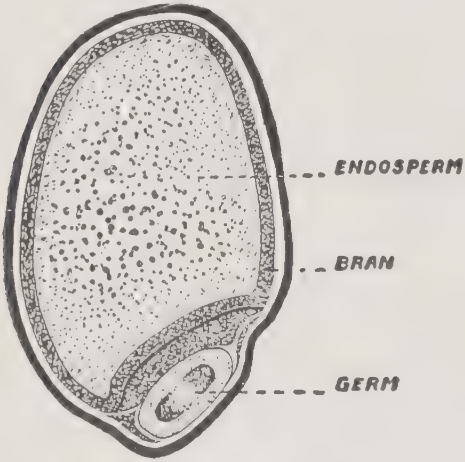
GENERAL COMPOSITION

The cereals are the hard kernels or seedlike fruits of certain plants of the grass family. In proximate composition the whole-grain cereals are similar, although the products made from them may vary decidedly in flavor and in texture:

	Per Cent
Water	10 to 12
Proteins	10 to 14
Carbohydrates	65 to 78
Fat	1 to 8
Mineral matter	1 to 2

(Cereals yield from 1,600 to 1,800 calories per pound.)

The seed kernel of the grain plant is composed of three parts: germ, endosperm and bran coat or husk. The illustrations (Figs. 87 and 88) show the structure of a grain of wheat, and may be taken as typical of all cereals.



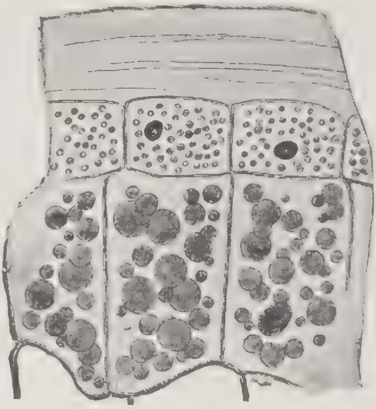


Fig. 87 (*Left*). A grain of wheat has three parts. All are used in whole-wheat flour, but only the endosperm in white flour. Note what a small part of the grain is germ. (From Wellman's "Food Plannings," Lippincott.)

Fig. 88 (*Right*). The outer or bran layer of the wheat grain contains cells richer in protein (aleuron layer) than the central starch-holding or endosperm cells. (From Broadhurst's "Bacteria in Relation to Man." J. B. Lippincott Co.)

The endosperm makes up about 85 per cent of the wheat, as it contains all the materials stored for use by the developing germ. The food is stored mainly in such forms as starch grains and gluten granules. Gluten is a mixture of two proteins, both insoluble in water, and, like starch, available only when the cellulose walls of the cells are broken by grinding or cooking.

The husk or bran is largely cellulose plus a large part of the mineral and vitamin B complex of the grain. The germ is the tiny portion which sprouts when the seed is planted and is the portion which spoils first in whole-grain products. Wheat germ practically free from bran is now on the market and serves as a palatable cereal supplement high in vitamin B complex and vitamin E. The keeping quality of wheat germ or products containing it has now been improved by a method of sterilization. Many cereals are now fortified with wheat germ or some other source of the B vitamins.

FOOD VALUE

The caloric contribution of cereals is considered one of their greatest assets. This would be important even if it was the only nutritive factor provided by them, both because they are used customarily at every meal and because of their low cost. Research has shown, however, that they are more than a supplement to other foods.

The protein content of grains in general ranges from 8 Gm. per 100 Gm. of uncooked rice to 14 Gm. per 100 Gm. of uncooked oatmeal. While it is not of such high quality as the protein from animal sources, it has been found that when it is supplemented by even a small amount of milk, it is a good source. According to L. A. Maynard of the Cornell School of Nutrition, cereals as the main protein source are quite adequate if some meat and milk are also taken. As this is common practice when grains are made into bread, are eaten as a breakfast cereal and are served at a meal where meat is the main dish, they may be considered an important source of protein. The fact that they are generally among the cheapest foods makes their contribution in this respect doubly important.

The mineral and the vitamin B complex content of the whole grain are higher than those of milled grains, but eating habits and the fact that whole grains and their products spoil more easily than the refined grains make it impractical to urge universal use of whole grains in the general diet. Recognition of these facts prompted the authorities in the national nutrition program to sponsor the restoration of refined grain products to nearly their whole-grain composition. For further discussion of this question see Chapter 50.

Manufacturers of breakfast cereals voluntarily have brought their products up to whole-grain value through adding minerals and vitamins to the amount removed during the process of manufacture.

The food value of a breakfast cereal is indirectly increased by the fact that a liberal amount of milk is taken with each bowl of cereal. The average person eats most cereals (1 oz.) with ½ cup of whole milk and 1 teaspoon of sugar. This combination of cereal, milk and sugar represents, for the moderately active woman, the following percentages of her recommended total daily food requirements: *

DIGESTIBILITY

Cereals are easily digested by the normal person. The fact that they are

CONTRIBUTION OF A BOWL OF CEREAL, MILK AND SUGAR TO DAILY FOOD REQUIREMENT

	Recommended Daily Requirements *	Supplied by Cereal, 1 oz.; whole milk, 4 oz.; sugar, 1 tsp.	Percentage Total Daily Requirement per cent
Calories	2,500.0	215.0	9
Protein	60.0 Gm.	8.0 Gm.	13
Calcium	0.8 Gm.	0.16 Gm.	20
Iron	12.0 mg.	1.69 mg.	14
Thiamine	1.2 mg.	0.20 mg.	17
Riboflavin	1.6 mg.	0.24 mg.	15
Niacin	12.0 mg.	1.0 mg.	8

* Based on allowances of National Research Council for moderately active women.

not made ready for absorption so quickly as sugar, the simplest form of carbohydrate, is usually an advantage, as for this reason they aid in keeping the stomach filled to the proper point. Refined cereals are bland in flavor and in texture, and this may be an advantage in certain conditions. Whole cereals, on the other hand, are advantageous in some cases, as they may stimulate the digestion of other products. However, the roughage in the form of bran which they contain may be a disadvantage in other cases.

PLACE IN THE MENU

Breakfast Cereals. Ready-to-eat cereals and those which must have long or short cooking in the home kitchen have a large use at breakfast. Some are also eaten at other meals. They may form a part of the children's supper, and some are used as ingredients of "made" dishes. In dry form, either the ready-to-eat or the precooked or the porridge-type cereals are used in cookies, muffins and other breads. The rolled ready-to-eat cereals make a good topping or coating for a variety of foods, and may be used as a foundation for quick pastry.

As far as food value is concerned, it makes little difference whether a hot cereal or a ready-to-eat cereal from the same type of grain is used. An ounce of one in dried form, whether it is cooked at home or made ready for consumption at the factory, will equal an ounce of another. The preference of a patient for one cereal or another is the first consideration. In general, unless the patient likes the same product day after day, a variety will add interest to the breakfast tray. Ready-to-eat cereals now come packed in a variety package. It should be noted that the roughage content, which differs greatly, may be a factor in the choice of one or another.

Rice, corn meal or hominy and buckwheat grits are largely used in the South and in every other section by certain national groups as accompaniments to meat and as a foundation for main dishes. Examples are Southern spoon bread, hominy pudding, Italian polenta and gnocchi, the Russian kasha or buckwheat grits and the general use of rice by all Orientals. Of these products, rice has perhaps the most general use and needs special care in cooking so that each grain will be separate and dry.

Macaroni, spaghetti and noodles are grouped as pastes or "pasta," but they are actually cereal products. A special form of hard wheat is used in their manufacture. From the same paste, macaroni, spaghetti and the even thinner vermicelli are produced. For noodles there is an addition of eggs. These may be made in the home kitchen, but they are generally purchased, as are the rest of the pastes, in packaged form. Paste products need only a small amount of cooking in boiling salted water to make them tender, and should not be overcooked. They are generally used in combination with a highly seasoned sauce. Grated cheese is usually considered a necessary accessory. While these products are sometimes used as an accompaniment to meat, they often form the main dish of a meal in which a small amount of meat may, or may not, be used. Vermicelli is generally used as an addition to a meat soup, to which it gives body and food value.

Breads and other products made with flour will be discussed in Chapter 50 (Bread, Batters and Doughs). As bread in some form is used at every meal by most persons, it has an important place in the menu.

FIG. 89. A baked apple and a ready-to-eat cereal may be used either for breakfast or for a light supper.

PREPARATION

There are three principal ways in which to prepare cereals for human consumption: factory cooking and drying, as in the ready-to-eat cereals; cooking in water to soften, as in the case of hot cereals and paste products; and using as an ingredient in bread and other products made with flour which are afterwards baked. Whatever method is used, three purposes should be accomplished: the softening or the rupturing of the cellulose walls or coverings; the preparation of the starch for digestion; and the improvement of flavor. While it requires only a relatively short time to cook the starch sufficiently to change it from an insoluble to a soluble form capable of being acted upon by the saliva, longer cooking may be needed to soften the cellulose thoroughly, the amount of time depending upon the size of the grain or the fineness of the particles into which it has been ground.

Ready-to-eat cereals, usually packed in cartons lined or covered with waxed paper, need no home preparation unless the box has been opened for some time, when, especially in warm weather, they may need to be crisped in the oven before use.

Porridge-type cereals such as oatmeal, ground-wheat products and corn meal need a certain amount of cooking with water. Some cereals of this type are precooked under pressure

Fig. 90. Hot cereal for breakfast.

at the factory and, therefore, need only short cooking in the home. For this reason, they may be prepared over direct heat if this is kept low and the product is stirred occasionally. Many persons prefer a cereal which has not been stirred too much, as this gives it a pasty texture. For cereals such as corn meal, hominy and buckwheat grits, cracked wheat and old-fashioned oatmeal which have not been precooked at the factory, the double boiler is preferable to the open kettle, as its use will prevent scorching during the long process of cooking. No stirring will be necessary. A pressure cooker of small size may be used if directions are followed exactly.

When breakfast cereals are cooked for serving at a meal, the directions on the package should be followed, unless for some reason it is desirable to have a softer texture than the precooking at the factory provides. When they are to be used for infant feeding, gruels, jellies or waters, longer cooking is desirable. In this case the following chart should be consulted. Corn meal, although used more often as a foundation for a dish such as fried mush or spoon bread than for a breakfast cereal, is included in the chart.

BREAKFAST-CEREAL RECIPES

Basic Recipe for Cooking Cereal in Small Quantities

Ingredients:

Kind	Amount of Cereal	Liquid	Salt	Time, hrs.
Rolled Oats	⅓ cup	1 cup	¼ tsp.	1–2
Wheatena	¼ cup	1 cup	¼ tsp.	½–1
Corn meal	2½ tbsp.	1 cup	¼ tsp.	2–3
Other fine cereals	2½ tbsp.	1 cup	¼ tsp.	½–1

Procedure: Have the water boiling in the top of a small double boiler over direct heat. Add salt, then add the cereal very slowly to the boiling water, stirring constantly. Boil 2 minutes. Place over hot water in the under part of double boiler. Cover and allow to cook the necessary period of time. If too dry, add more boiling water. Dates, raisins or prunes may be added for variation in flavor. For extra food value, 2 tablespoons powdered dry milk may be mixed with the dry cereal. Yield: 2 servings.

CEREALS

Oatmeal Gruel

Ingredients:

- ¼ cup rolled oats
- ½ teaspoon salt
- 1½ cups boiling water

Procedure: See general directions for cooking cereals (above). Cook 3 hours. Add more water if necessary. Strain and serve with cream. Yield: 2 servings.

Oatmeal Jelly

Ingredients:

- 4 tablespoons rolled oats
- 3 cups boiling water
- ½ teaspoon salt

Procedure: Follow directions for oatmeal gruel. Strain into molds, chill and serve with sugar and cream. Yield: 4 servings.

Oatmeal Water

Ingredients:

- 1½ tablespoons rolled oats
- ½ teaspoon salt
- 2 cups boiling water

Procedure: Follow directions for oatmeal gruel.

Rice Jelly

Ingredients:

2 tablespoons rice flour
¼ teaspoon salt
1 cup boiling water
Cinnamon or lemon juice

Procedure: Mix rice flour and salt with enough cold water to make a thin paste, and then add boiling water, stirring constantly. Boil until rice flour is transparent. Add cinnamon or lemon juice as flavoring, if desired. Pour into a mold, and when set unmold. Serve with sugar and cream or milk. Yield: 1 serving.

Barley Flour Gruel

Ingredients:

1 tablespoon barley flour
½ teaspoon salt
1½ tablespoons cold water
1½ cups boiling water

Procedure: Mix flour and salt with cold water. Add boiling water gradually, stirring constantly, and boil until thickened. Salt to taste. Strain through a very fine sieve. Yield: 2 servings.

Barley Jelly

Ingredients:

2 tablespoons barley flour
4 tablespoons cold water
2 cups boiling water
½ teaspoon salt

Procedure: Follow directions for barley flour gruel. Strain into molds, chill and serve with sugar and cream. Yield: 4 servings.

Corn-meal Gruel

Ingredients:

2 tablespoons corn meal
½ cup cold water
½ teaspoon salt
1¼ cups boiling water

Procedure: See general directions for cooking cereals (page 439).

Flaked Cereal Gruel

Ingredients:

1 cup boiling water
¼ teaspoon salt
1 cup toasted cornflakes or other toasted flake cereal

Procedure: Combine boiling water and salt, stir in cornflakes. Stir over low heat until cereal is very soft and strain. Yield: 2 servings.

High-Calorie Cereal Gruel

Ingredients:

¼ cup farina
½ teaspoon salt
2 cups boiling water
1½ cups hot milk
3 tablespoons lactose

Procedure: Add farina slowly to salted boiling water and cook over direct heat until thickened. Add hot milk and lactose, cook over water for 1 hour. Yield: 6 servings.

RICE RECIPES

The most common methods for cooking rice are boiling and steaming. For the first method, plenty of rapidly boiling water is necessary. When the rice is tender, it should be drained, rinsed with hot water, drained again and then placed for a few moments over boiling water or in the oven so that it will be fluffy. This is the method generally used when rice is to be served as a vegetable or used as the basis of a dish. Steaming is used when rice is cooked in milk for use as a dessert, or when it is desirable to obtain a very tender texture. Another method—which, however, is more suitable for rice cooked in quantity for a family—is to cook the raw rice for a few minutes in butter or other fat while stirring constantly, then add three times as much boiling water as rice, cover and cook over low heat until rice is tender.

Boiled Rice

Ingredients:

- ¼ cup rice
- 3 cups boiling water
- ½ teaspoon salt

Procedure: Look over rice grains and wash thoroughly. Add slowly to boiling salted water. Boil actively about 20 minutes or until the grains are tender. When tender, place in strainer, rinse with hot water. Cover with a towel and place over boiling water to fluff. Yield: 1 serving.

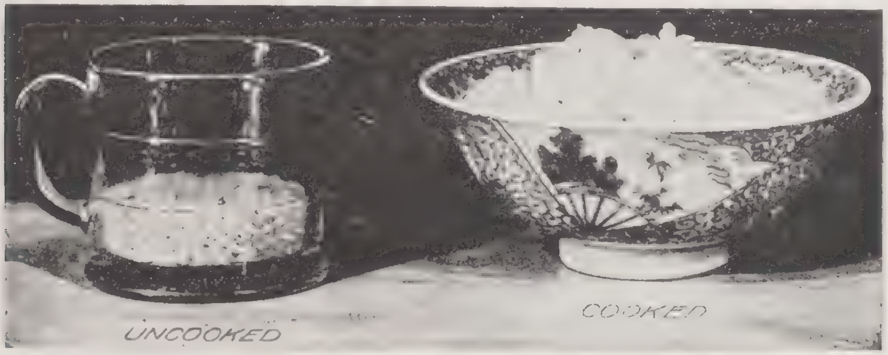


Fig. 91. Equal amounts of rice, cooked and uncooked, showing difference in volume. (Bureau of Home Economics, U. S. Department of Agriculture.)

Steamed Rice

Ingredients:

- ¼ cup rice
- ¼ teaspoon salt
- ¾ cup hot milk

Procedure: Look over rice carefully, wash and add slowly to salted hot milk in top of a small double boiler. Cook about 1 hour until rice is tender. 1 cup water may replace the milk. Yield: 1 serving.

Baked Rice and Cheese

Ingredients:

- ½ cup cooked rice
- ½ cup cream sauce (page 521)
- ¼ cup grated cheese
- 2 tablespoons soft breadcrumbs
- 1 teaspoon melted butter
- ¼ teaspoon paprika

Procedure: Mix rice lightly with hot cream sauce and grated cheese. Place in small greased baking dish. Mix breadcrumbs lightly with melted butter. Place on top of the rice mixture and sprinkle with paprika. Bake in a moderate oven (350° F.) about 15 minutes until crumbs are lightly browned. Yield: 1 serving.

Note: If desired, the grated cheese may be stirred into the hot cream sauce until melted and thoroughly blended.

Baked Rice with Tomato

Ingredients:

- ½ cup cooked rice
- 1 teaspoon minced onion
- 1 teaspoon minced parsley
- ½ cup condensed tomato soup
- 1 tablespoon grated cheese

Procedure: Mix rice with onion, parsley and tomato soup and place in a greased individual baking dish. Sprinkle with grated cheese and bake in a moderate oven (350° F.) about 10 minutes until cheese is melted. Yield: 1 serving.

MACARONI AND NOODLE RECIPES

Macaroni, noodles and other paste products, often known as pastas, should be cooked in plenty of boiling salted water until tender but not too soft. They should be drained, rinsed with hot water and drained again before being used as a foundation for a dish. Time of cooking will vary slightly with the brand of product used, and for this reason directions on the package should be followed.

Baked Macaroni with Cheese

Ingredients:

¼ cup broken macaroni
½ cup grated cheese
½ cup cream sauce (page 521)
Salt
Pepper
1 tablespoon butter

Procedure: Cook macaroni in 2 cups boiling salted water from 8 to 10 minutes (until tender). Drain and arrange in small greased baking dish. Sprinkle with salt, pepper and cheese, and add cream sauce to cover macaroni. Dot with butter and bake in moderate oven (350° F.) until cheese is melted and slightly brown, from about 15 to 20 minutes. Yield: 1 serving.

Baked Macaroni with Tomato

Ingredients:

¼ cup broken or elbow macaroni
1 tablespoon butter
1 teaspoon minced onion
1 teaspoon minced green pepper
1 teaspoon minced celery
½ cup canned tomatoes
¼ teaspoon salt
2 tablespoons soft breadcrumbs
1 teaspoon melted butter

Procedure: Cook macaroni in boiling salted water until tender (from about 8 to 10 minutes) and drain. Melt butter, add onion, green pepper and celery and cook 2 minutes over low heat. Add tomatoes, salt and drained macaroni. Blend well, add more salt if necessary, and place in a small greased baking dish. Mix breadcrumbs with 1 teaspoon melted butter and sprinkle over macaroni. Bake in a moderate oven (350° F.) until crumbs are slightly browned, from about 15 to 20 minutes. Yield: 1 serving.

Note: 1 tablespoon grated cheese may replace the buttered breadcrumbs.

Noodles with Browned Crumbs

Procedure: Cook one sixth of the contents of a package of noodles as directed on package and drain. Melt 2 teaspoons butter, add 2 tablespoons fine dry crumbs and stir over low heat until lightly browned. Add another teaspoon butter and combine mixture with hot drained noodles. Yield: 1 serving.

Noodles with Cheese Sauce

Procedure: Cook one sixth of the contents of a package of noodles as directed on package and drain. Prepare half the recipe for rich cheese sauce (see page 521) and toss noodles into this mixture. Yield: 1 serving.

REVIEW QUESTIONS

1. Outline the changes in cereal consumption from Colonial times to the present.
2. What grains are most commonly used in the United States today?
3. Compare the nutritive contributions of an average serving of cooked oatmeal with those of an average serving of a ready-to-eat cereal.
4. What type of cereals should be used when roughage must be avoided? Which cereals when roughage is an advantage?
5. Discuss the nutritive contribution made by cereals in general.
6. Which cereal products are known as pastes, and from which grain are they prepared?
7. In what circumstances is it advisable to cook the porridge-type cereals longer than the directions on the package advise?

41

Fruits and Nuts

Chapter Topics

- FRUITS
  - FOOD VALUE
  - DIGESTIBILITY
  - PLACE IN THE MENU
  - PREPARATION
    - FRESH FRUITS
    - FROZEN FRESH FRUITS
  - RECIPES
    - RAW FRUITS
    - COOKED FRUITS
- FRUITS (CONT.)
  - DRIED FRUITS
  - CANNED FRUITS
  - CANNED FRUIT JUICES
  - FROZEN FRESH FRUIT JUICES
- NUTS
  - FOOD VALUE
  - DIGESTIBILITY
  - USE IN THE MENU

Fruits and nuts have been grouped for discussion in this chapter because of their botanical relationship. They have little in common as regards food value or use in the menu, therefore their functions as food will be considered separately.

FRUITS

Fruits make a strong appeal to the appetite through the senses of sight, smell and taste. Shape, color, delightful aroma and delicious flavor all contribute to popularizing this group of foods and to making it easy to find a place for them on the menu, to which they contribute nutritionally.

Food Value

The most important contribution of fruit to the diet is its vitamin content. It is particularly high in ascorbic acid, commonly known as vitamin C, which is supplied by fresh fruits in varying amounts. Clinical experience indicates that many adults in the United States do not get enough of this vitamin, more often because of lack of appreciation of its value and food sources than of its cost. It has been noted that the use of aspirin, which is so common, may destroy some of the ascorbic acid in the body.

Ascorbic Acid. The best sources of ascorbic acid among fruits are the citrus family and tomatoes. Research has shown that the ascorbic-acid content of certain berries is high. Black currant juice, for instance, was used in Britain with great success to supply ascorbic acid to children during World War II. In the United States, wild blueberries have been found to be fairly well endowed with this vitamin. The buffalo berry, native to North Dakota and near-by states, and papayas and guavas grown in Florida and Hawaii are also high in vitamin C content. Practically all fruits can be counted upon for a certain amount of ascorbic acid. While fruits such as apples, pears and grapes do not contribute largely, they may be a significant source if eaten liberally in raw form. Cooked fruits may still retain some vitamin C, but losses of ascorbic acid in cooking vary: berries, 15 per cent; acid fruits, 25 per cent; most others, 30 to 40 per cent. (See Fig. 92.)

Storage in Refrigerator. Citrus fruit juices, in both fresh and canned form, can be stored in the refrigerator without loss of more than a small amount of their ascorbic-acid content. This is convenient in the case of canned juices, when large cans are purchased as an economy.

A study of the effects of refrigerator storage of fruit juices reported in "Nutrition Reviews," 1944, sums up the question as follows:

"After one day of refrigeration the average loss of ascorbic acid from freshly opened cans was 3 per cent for grapefruit, 3.7 per cent for orange, 1.1 per cent for pineapple and 24.1 per cent for apple juice. In 3 days of refrigeration the loss from grapefruit juice was only 5.6 per cent. The losses were the same whether the juice was stored in the open can or in a covered glass jar." It should be noted, however, that the flavor of fresh fruit juice is better when taken at once than after standing, and this should be considered when serving the ill or convalescent patient.

CANNED FRUIT JUICES AS SOURCES OF VITAMIN C

The amounts of each juice necessary to supply the same amount of vitamin C as 4 oz. of fresh orange juice (⅔ of day's requirement).

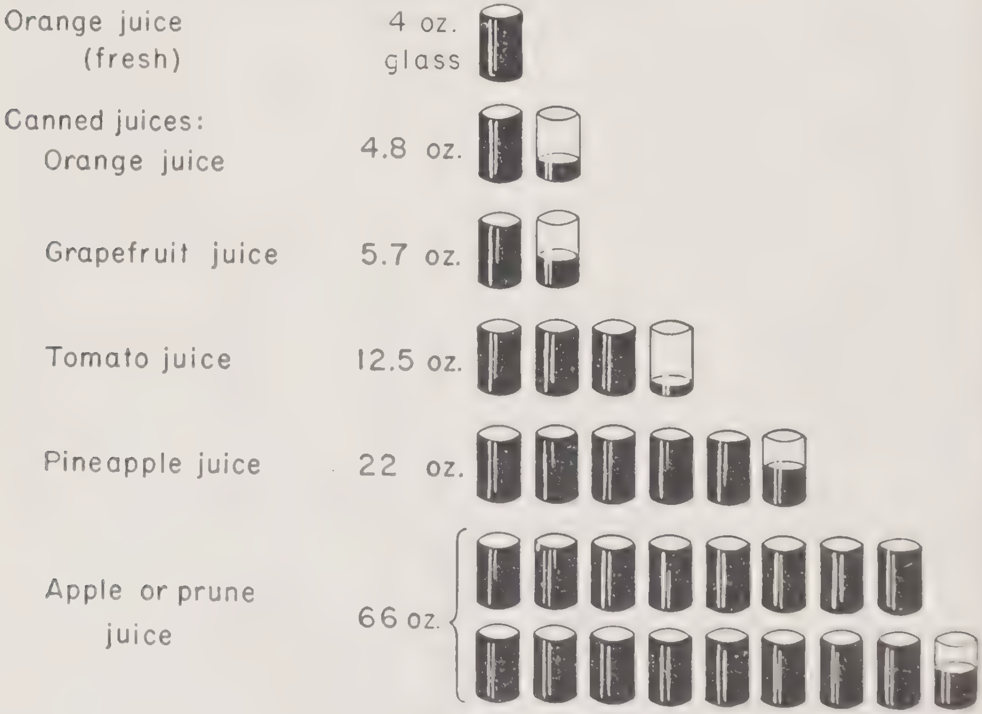


Fig. 92.

Vitamin A. Most fruits supply vitamin A in varying amounts. The best sources are apricots, cantaloupes, yellow peaches and prunes, all of which show in their pulp the color which is usually a sign that vitamin A is present. Dried fruits are the only ones which contain appreciable amounts of the B complex.

Mineral Content. Fresh fruits are comparatively low in minerals, but in general they supply an appreciable amount of iron and calcium. Dried fruits, because of the removal of water, are more concentrated sources of all factors. When they are soaked and cooked, they of course return to the approximate composition of fresh fruits. Dried fruits are among the highest contributors of calcium, while oranges, raspberries and strawberries supply a moderate amount. The most iron is found in apricots, avocados, bananas, dates, figs, grapes, raisins, prunes, raspberries and strawberries. The best source of copper is prunes. Blueberries are particularly rich in manganese.

Effect upon Acid-Base Balance. One of the important functions of fruit, which is related to its mineral content, is its effect upon the acid-base balance of the body. Fruit is relatively low in the acid elements—phosphorus, sulfur and chlorine—and higher in the basic elements—sodium potassium and magnesium. In metabolism, an alkaline ash is therefore formed which helps to neutralize the acid ash of cereal foods and meat. The citric-acid compounds of lemon, grapefruit and oranges and the malic acid of apples, peaches, berries and other fruit are easily burned in the body and leave an alkaline residue. The acids in prunes, plums, rhubarb and cranberries are not well utilized in the body, and for this reason these fruits must be classed as potentially acid, although they do have an alkaline ash. Because fruits have an acid taste, all are often mistakenly considered as belonging to a class that leaves an acid rather than a potentially alkaline residue. During digestion, fruits retain their natural acids, which are an aid to the passage of food, except when an oversupply of hydrochloric acid is present in the stomach.

Caloric Value. The caloric value of fruits is comparatively low. This is chiefly carbohydrate and is usually in the form of sugar. Dried fruits, when eaten as such, are high in calories, but after their water content is restored they return to their original natural value. The caloric value of canned fruits and frozen fruits is increased according to the amount of sugar used in their preparation. The avocado pear and the olive are distinguished from all other fruits by their high fat content, which gives them a comparatively high caloric value.

Digestibility

Fruits are easily digested by normal persons. Much of the carbohydrate is in the form of sugars, glucose and fructose, which are ready for immediate absorption and thus require no digestion in the alimentary tract. With color, odor and flavor all combining to whet the appetite and, therefore, stimulate the flow of the digestive juices, digestion and absorption are naturally rapid. Perhaps it should be mentioned at this point that the prejudices against the use of milk or starchy foods with acid fruits are without foundation.

Fresh fruit should be ripe, but not overripe. Bananas, when the skins are flecked well with brown, may be used even in the diet of children and invalids. For infants they should be mashed or strained. Certain fruits which are not well tolerated in raw form are easily digested when cooked.

A factor which makes fruits of value in the diet is the bulk furnished by the cellulose and the hemicellulose, which stimulate peristalsis. Prunes and figs may even produce a mild laxative effect. The pectin content of some fruits may also be of aid in intestinal disturbances. Seedy berries and apple skins are not always well taken, as they may be constipating to some persons. For details on acid-base foods, cellulose and digestion, see Chapters 7, 9 and 10.

Place in the Menu

The custom of serving fruits twice a day, for breakfast and at some other meal, is good standard nutrition practice. It applies in illness as well as in health if there is no therapeutic reason, which there seldom is, against it. The appetite of a patient may often be tempted more by fruits than by any other type of dessert, and as fruits need little preparation, this will often be a convenience. Use may be made of the large variety of fresh, frozen, canned and cooked dried fruits according to their availability in the market.

A citrus fruit is generally chosen for breakfast. For lunch or dinner, another type of fresh fruit or some cooked or canned fruit may be served unless the patient prefers a citrus fruit more than once a day. In this case, orange juice might be offered for breakfast and grapefruit in the fresh or broiled form for dessert at another meal. Both grapefruit and oranges may be combined with other fruits for a compote. When acid fruits must be omitted from the diet—as, for instance, in cases of hyperchlorhydria or ulcer (see Chaps. 24 and 25)—nonacid fresh fruit, canned and dried fruit should be alternated.

Preparation

FRESH FRUITS

Large fruits such as apples, pears, peaches, plums, oranges and grapefruit should be washed in order to remove any traces of spray which may be present. If fruit is just ripe enough to eat, it should be put in the refrigerator to prevent softening, but should not be served too cold. Overripe fruits should never be served.

Bananas should be ripened at room temperature until the skins are flecked with brown. If bananas are to be served sliced, they should be prepared at the last moment.

Berries should be kept in the refrigerator until just before serving, when they should be washed thoroughly to remove spray and drained well after washing. Strawberries should be hulled, unless they are to be served whole round a round of sugar. Grapes and cherries should be washed thoroughly and drained as dry as possible.

Melons should be ripe, but not overripe. They should be chilled and prepared just before serving. Cantaloupes should be halved, other melons cut in slices, and the seeds carefully removed. Sliced lime or lemon may be served with honeydew or casaba melon.

Peaches. Peaches, if ripe, should be kept in the refrigerator. If green, they should be allowed to ripen at room temperature. If they are to be served whole, they should be washed and dried. If they are to be served sliced, they should be peeled and sliced just before they are to be served. Sprinkling with lemon juice will de lay change in the color which is caused by exposure to air. They may be sprinkled with sugar at time of slicing, or sugar may be passed with them.

Pears. Pears, if ripe, should be washed and placed in the refrigerator. Otherwise they should be allowed to ripen at room temperature. They are generally served whole and unpeeled. A large juicy pear of the Comice variety may be halved just before serving if desired.

Pineapple. Pineapple should be kept at room temperature. The easiest method of preparation is to cut the fruit in thick slices, to pare each slice and then to shred with a fork. Sugar is generally necessary, and the flavor will be improved if it is added to the shredded fruit half an hour before serving. It should then be allowed to stand at room temperature, not in the refrigerator. The fruit may be cut in wedges and served around a mound of powdered sugar.

Citrus Fruits. Oranges and grapefruit are used for table service more than any other type of citrus fruit, as they are in season throughout the year. Tangerines are available during some of the winter months, as are kumquats. Lemons and limes have some use as a garnish, when they may either be sliced or cut in wedges. For either purpose, the seeds should be removed. The squeezed juice of either often serves as a flavoring for cold drinks and some desserts and sauces. Citrus fruits are usually stored in the re-

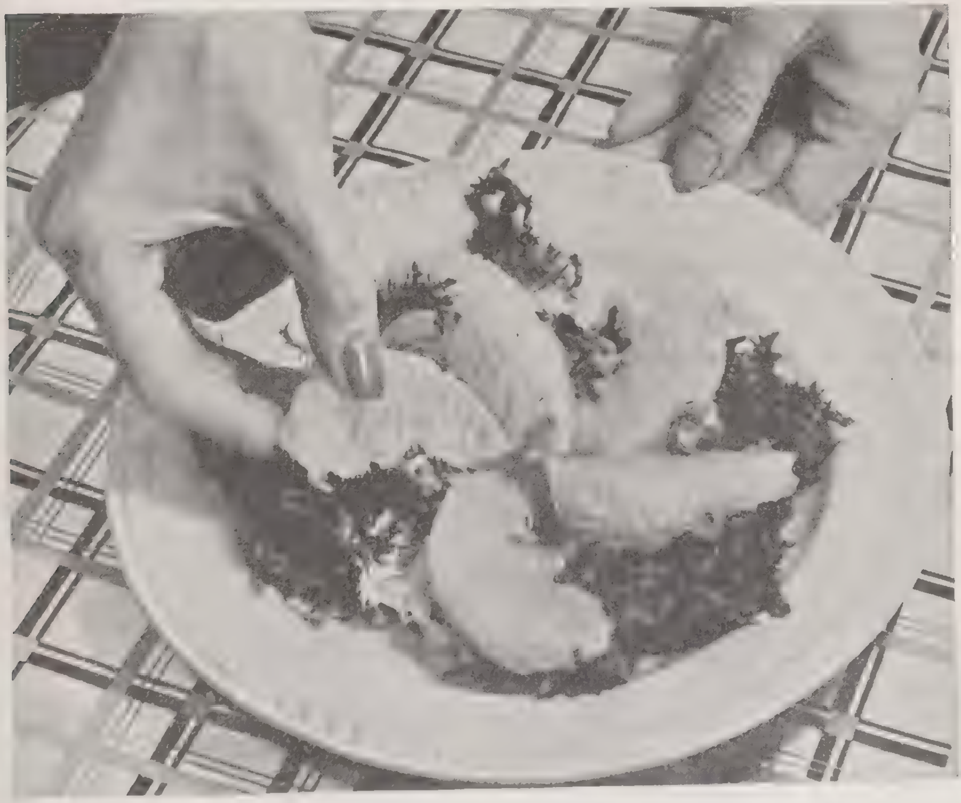


Fig. 93. Preparation of grapefruit for salad.

frigerator, although they will keep some time at room temperature. In any case, they should be chilled before being used.

Oranges are served in juice form more often than any other. Fresh grapefruit juice is sometimes used. Both should be chilled in the refrigerator before they are cut and squeezed. Ice should not be put in the juice; nor is it desirable from the standpoint of flavor that it should be chilled after it is expressed, although it has been found that there is little loss of vitamin C by refrigerator storage for a moderate length of time. If it is necessary to strain juice on account of the seeds, a coarse strainer should be used, as a goodly proportion of the vitamin C remains in the pulp.

Large oranges and grapefruit may be served in the shell after they are halved and the segments have been loosened. To prepare, run a sharp knife between the peel and the pulp and loosen the segments from the fiber which separates them, but do not cut the fiber partitions. The fruit should be served without sugar, which may be added if desired. Citrus fruits today have a large natural sugar content and seldom need any additional sweetening. Both oranges and grapefruit may be served in sections by themselves or in combination with other fruits. They should be pared deeply enough to remove the inner fiber of the skin, after which the sections may be lifted out without destroying the shape. Seeds, if present, should be carefully removed. Navel and Valencia oranges, which are free or almost free from seeds, may be pared and sliced. These oranges and tangerines are sometimes served whole after the rind has been sectioned and turned back round the fruit. To section the rind, run sharp knife five or six times from stem to blossom end, being careful not to cut pulp, then loosen each section of skin carefully and turn in toward fruit.

FROZEN FRUITS

Fresh fruits of an increasing variety are now available in the quick-frozen form. They may be allowed to thaw at room temperature and should be used as soon as possible after thawing has been completed. If only a small amount is required at one time, such portion should be cut from the frozen block of fruit and the remainder placed at once in the freezing compartment of the refrigerator.

Recipes

RAW FRUITS

Fresh Fruit Compote

Procedure: A combination of fresh fruits is known as a compote or a cup. The fruits should be put together and sweetened with powdered sugar just before serving. Fruit should then be arranged in a sherbet glass. A tablespoon of sherry, port, brandy or any cordial may be added. The fruit may be garnished with a sprig of mint or it may be topped with a tablespoon of lemon, orange or pineapple ice.

Ambrosia

Procedure: When ready to serve, mix equal parts of orange sections and sliced bananas. Sprinkle with fresh, grated coconut. Sweetened, shredded pineapple or grapefruit sections may also be used in ambrosia.

Avocados

Procedure: Select ripe avocados which are slightly soft to the touch. The skin of a ripe avocado is usually dark green. Prepare fruit just before ready to serve so that flesh will not darken. Cut in half, remove pit. Serve without paring with lemon juice or catsup in the cavity as a first course. Pare and slice for use in salads or dice for fruit cup.

COOKED FRUITS

Apple, Baked

Ingredients:

1 cooking apple, medium size
2 tablespoons sugar
Dash cinnamon or nutmeg

Procedure: Wash and core apple carefully from blossom end almost to stem. Pare 1 inch of skin round top. Mix sugar and cinnamon or nutmeg and fill apple with mixture. Place in small baking dish and add water to the depth of ¼ inch. Cover and bake in moderate oven (375° F.) about 30 minutes (until tender). Apples may be glazed by sprinkling with sugar and placing under the broiler flame about 5 minutes until sugar melts. Serve hot or cold. Yield: 1 serving.

Note: If patient is fond of baked apples, 2 or more may be prepared at the same time. Increase amounts of sugar and spice accordingly.

Applesauce

Procedure: Wash, core and slice 2 tart cooking apples, place in a small saucepan with just enough water to cover. Cover and cook over low heat from 8 to 10 minutes (until soft). Rub through coarse strainer. Sweeten to taste and stir until sugar is dissolved. Add lemon juice or lemon rind, if desired. Yield: 2 servings.

Stewed Apples

Ingredients:

2 cooking apples, medium size
¼ cup sugar
1 cup boiling water
Dash nutmeg or cinnamon

Procedure: Wash apples, cut into eighths. Pare and core. Place in cold water as each section is ready. Combine sugar and boiling water in a shallow saucepan and stir over low heat until sugar is dissolved. Add cinnamon or nutmeg. Drain apples, and cook in sirup until transparent. Add boiling water to sirup if it thickens during cooking. Serve hot or chill before serving. Yield: 2 servings.

Banana, Baked

Procedure: Peel banana, place in shallow baking dish and brush with melted butter. Bake in moderate oven (375° F.) from 10 to 15 minutes (until tender) and serve hot as a vegetable. Yield: 1 serving.

If used as dessert: Sprinkle cooked banana with lemon juice and powdered sugar.

Grapefruit, Broiled

Procedure: Wash and dry grapefruit, and cut in halves crosswise. Remove seeds, loosen pulp in sections and remove center cores. Place fruit in baking pan, sprinkle each half with 2 tablespoons brown sugar and dot with 1 teaspoon butter. Broil 6 inches from low broiler heat about 15 minutes.

Note: Add 1 tablespoon of wine or rum to each half, if desired.

Pears, Stewed

Ingredients:

2 pears, medium size
6-8 cloves
¼ cup sugar
¼ cup boiling water

Procedure: Wash fruit and pare. Stud each pear with cloves and arrange in shallow saucepan. Sprinkle with sugar. Add water. Cover and cook over very low heat until tender when tried with a toothpick. Serve hot or cold. Yield: 2 servings.

Plums, Stewed

Ingredients:

8 plums
Water
¼ cup sugar

Procedure: Wash plums and prick with fork. Place in small saucepan and add water to half cover. Cover and cook over low heat about 10 minutes (until soft). Add sugar. Stir carefully into sirup and cook uncovered about 2 minutes, until sirup thickens slightly. Yield: 2 servings.

Rhubarb, Stewed

Ingredients:

1 lb. rhubarb
½ cup sugar

Procedure: Trim rhubarb, removing leaves and stem ends of stalks. Wash and cut in 1-inch pieces. Place with sugar in top of double boiler and cook, covered, over hot water, until rhubarb is soft. Yield: 3 servings.

Dried Fruits

Dried fruit should be washed thoroughly. Unless directions on package state otherwise, soak in just enough water to cover for several hours. Cover and cook over low heat in the water in which it was soaked until the fruit is soft. Add sugar to taste, stir until dissolved and keep covered while cooling. Sweet prunes will need no extra sugar. A slice or two of lemon or orange may be cooked with prunes if desired. Stewed dried fruits are usually served cold. Raisins, figs and dates are usually eaten in their own form or are used as an ingredient in a dessert.

Canned Fruits

Canned fruits should be thoroughly chilled before serving. Any fruit may be served in its own sirup or combined with another fruit fresh or canned. Suggested combinations are: Canned apricots and canned cherries; sliced peaches and pineapple wedges; sliced oranges and cherries.

Canned Fruit Juices

Canned fruit juices have grown in variety and popularity in the last few years. Grapefruit juice and tomato juice are staple products. Pineapple juice, grapejuice, apple juice, prune juice and fruit nectars are other canned fruit-juice products which may find a useful place on the invalid's tray. Canned orange juice has improved greatly in flavor under modern conditions of packing. It may be obtained in combination with grapefruit juice. It should be noted that some of the fruit juices are obtainable with or without sugar. The label on the can gives this information. Like fresh fruit juices, the canned fruit juices do not lose vitamin C content quickly if they are refrigerated after the cans are opened, but storage may have an effect on flavor. Fruit juice may be stored in the can without undesirable results.

Frozen Fresh Fruit Juices

Frozen concentrated orange juice is a recent addition to the list of fruit juices. Flavor and texture are practically the same as those of freshly squeezed fruit.

NUTS

The word nut is defined in the dictionary as "a dry fruit or seed having a separable rind or shell and interior kernel or meat." All the products called nuts fall under this definition, excepting peanuts, which, instead of being the fruit of a tree, are tubers, the underground product of a vine. The nuts most commonly used are peanuts, walnuts, pecans, almonds and Brazil nuts. Coconut, especially in dried, shredded form, is also largely used.

Food Value

The protein content of nuts is generally high, although there is a wide range in this, as will be seen by consulting the Table of Percentage Composition. The protein is of good qual-

PERCENTAGE COMPOSITION OF SOME NUTS

	Water per cent	Protein per cent	Fat per cent	Carbo-hydrate per cent	Calories per 100 Gm.	Calories per Lb.
Almonds, unblanched	5	19	54	20	642	2,888
Brazil nuts, shelled	5	14	66	11	694	3,123
Butternuts	4	24	61	8	677	3,046
Chestnuts, fresh	53	3	2	42	198	891
Chestnuts, dried	8	7	4	79	380	1,710
Coconut, dried, shredded	3	4	39	53	579	2,605
Filberts	6	15	66	14	710	3,195
Hickory nuts	4	14	67	13	711	3,199
Peanuts, roasted	3	27	44	24	600	2,724
Pecans, raw	3	11	70	15	734	3,303
Pine nuts (piñon)	3	13	61	21	685	3,082
Pistachios	7	20	53	19	633	2,848
Walnuts, black	3	18	58	19	670	3,015
Walnuts, English	3	15	64	16	700	3,150

ity, although not equal in every respect to that furnished by animal products such as meat, milk, fish, cheese and eggs. With the exception of chestnuts, which are also low in protein, the fat content is exceedingly high, and the oil obtained from peanuts and coconut has a larger use than these products in their own form. Most nuts are good sources of the vitamins thiamine, riboflavin and niacin. They contribute the minerals calcium, phosphorus, iron and copper in varying amounts according to the particular nut. Among the nuts in everyday use, almonds and Brazil nuts furnish the most iron.

Digestibility

Because of the high fat content, nuts digest slowly. Chopping or grinding improves digestibility. In the form of butter and combined with other foods, there is usually no digestive difficulty. Peanut butter may be used in sandwiches or as an ingredient of a dish, if the convalescent likes the flavor and the texture of this product, which is such a favorite with children.

Use in the Menu

In general, nuts are considered an accessory to a meal, except in the vegetarian's diet, when it is necessary to draw protein from all vegetable sources. Peanut butter is the only form in which nuts are used as a staple part of a meal. Chopped nuts are often used in cakes and in cookies, and as a flavor or a garnish for various types of puddings and other desserts. They may occasionally be used as a topping for creamed dishes and vegetables or as an accessory to them. As nuts are used so little in the invalid's diet, no specific recipes accompany this chapter.

REVIEW QUESTIONS

1. For what reason have fruits and nuts been grouped together for discussion in this chapter? Compare their nutritive contributions.

2. What are the most important contributions of fruits to the diet? List the best sources of ascorbic acid; of vitamin A.

3. List the fruits which supply appreciable amounts of minerals. Discuss the relation of fruits to the acid-base balance of the body.

4. Discuss the place of fruit in the menu.

5. What is the most valuable nutritive contribution of nuts?

6. Compare the digestibility of nuts with that of fruit.

7. Discuss the use of nuts in the menu.

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Eggs

Chapter Topics

FOOD VALUE
AVERAGE COMPOSITION
DIGESTIBILITY
PLACE IN THE MENU
PRINCIPLES OF COOKERY
RECIPES

That eggs are a favorite food is illustrated by the fact that commercial production before the war was estimated at several billion dozen per year. Although figures are not available, there was undoubtedly a large increase in production both from commercial sources and through the reinstatement of small flocks of poultry for the production of eggs to meet family needs. The eggs consumed still fall short of the standard of "one egg a day, if possible" set by the National Research Council as a nutrition ideal. A rough estimate of the average consumption at present is about four eggs per person per week.

Eggs have an especially high place in the diet of the invalid for a number of reasons. They are well liked by almost everyone. Nutritionally they score well. They are easily digested, are quick to prepare, and can also be used as an ingredient in so many dishes, to which they add palatability. However, they should not be used to excess.

FOOD VALUE

The food value of eggs can be most justly estimated by comparing them with meat and milk. They score slightly higher than meat on most counts. The protein, as would be expected from an animal food, is of the same high quality as that of meat and milk. In mineral content, eggs are much higher in iron but lower in calcium than milk. In common with milk they supply vitamin A and riboflavin, but in more generous amounts. Both foods contribute small amounts of thiamine. When eggs are cooked, approximately 20 per cent of the thiamine and the riboflavin are lost. Like milk, eggs are a poor source of vitamin C and niacin. They differ from milk in one respect, in that they are a natural food source of vitamin D. The vitamin content of eggs is dependent to some extent upon the type of feed given the hens which produce the eggs.

Most of the food value of the egg other than protein is concentrated in the yolk, in which most of the minerals and the vitamins are to be found. Both yolk and white contain protein, but the fat content is to be found in the yolk alone. Of the 75 calories furnished by the average egg, 55 are concentrated in the yolk.

AVERAGE COMPOSITION

While eggs differ in size, and for this reason in food value, one average egg does not differ materially from another in composition. There should be no prejudices in favor of either brown or white eggs. In spite of the fact that Bostonians will pay 10 cents a dozen more for brown, and that New Yorkers will do the same for white, eggs, there is no difference in food value or in flavor. The color of the yolk may vary with the ration of the hens, but the theory that highly colored egg yolk necessarily contains more vitamin A is not based on sound scientific evidence.

APPROXIMATE COMPOSITION OF HENS' EGGS

	Water	Prot.	Fat	Carb.	Calories per 100 Gm.	Calories per Lb.
Whole egg, edible portion........	74	13	12	1	164	745
White only....................	88	11	0	1	48	218
Yolk only.....................	49	16	32	1	356	1,616

DIGESTIBILITY

Eggs are easily digested by almost everyone, whether in raw or in cooked form. The fat is in an emulsified state like that of milk, and can be digested in the stomach as well as in the intestines, which is of advantage in certain dietary disturbances. In raw form they may be important in the first stages of a convalescent diet because of the food value which they add. Recent work has shown, however, that raw egg white contains a factor which may affect the utilization of vitamin biotin (see Chap. 8).

Raw eggs are not used in the invalid's diet to as large an extent as formerly, when it was believed that they were more easily digested than cooked eggs. Certain experimental work cast doubt upon the complete utilization of raw egg white; but by means of experiments with human beings, Rose and MacLeod show that the coefficient of digestibility may be almost as high for raw white of egg as for cooked. Beaten egg white, however, is more thoroughly absorbed than the white in its natural state. In liquid diets in which egg drinks are used, it is worth while to beat the egg whites.

Unless there is an allergy to eggs, they will seldom cause any digestive disturbance, whether they are served in raw or in cooked form. In certain stages of convalescence it may be necessary to press the yolks of hard cooked eggs through a sieve, when they will be as easily digested as eggs in any other form. The yolk of the raw or hard-cooked egg may be added to the infant's food formula at a very early stage, particularly because of its iron and vitamin potency. The white is generally omitted, as the additional protein which it mainly contributes is not needed and children may be allergic to the albumin of the white.

PLACE IN THE MENU

It is not a difficult matter to find a place in the diet for eggs, even when there is a prejudice against them.

They can be disguised easily in sauces, desserts and other "made" dishes. Occasionally one finds a natural sensitivity to eggs, and this can be overcome only by careful treatment. In the event that eggs must be eliminated completely from the diet, which, fortunately, is rare, care must be taken to supply other foods high in the same nutrients. In general, however, eggs will be found to be one of the most important constituents of the nourishing and easily digested diet so important in convalescence. Combined with milk or fruit juice, they are used in a liquid and a semiliquid diet, and the first solid food is often an egg in soft-cooked or poached form. Scrambled eggs and omelet follow. Later combinations of poached or boiled eggs with savory sauces may appear on the invalid's tray for lunch or supper.

Fig. 94. Poached eggs on toast ready for a meal.

Fresh eggs of the best quality should be used when eggs in any form appear on the menu. One taste of an egg which is not perfectly fresh may prejudice the patient against this valuable food. In places which grade eggs before marketing, Grade A quality should be chosen whenever eggs are to be served in their own simple form. Grade B eggs are satisfactory for use as an ingredient for hot breads and cakes. The term fresh to describe an egg of high quality is still used. Actually, eggs gathered soon after being laid, wiped if necessary and cooled and packaged for shipment to a market at some distance may pass the "candling" test better than an egg only a few days from the nest but not subjected to immediate cooling. Good-quality eggs, under proper storage conditions, will pass the Grade A test after some time in cool storage. Size, by the way, is not a basis for grading.

For commercial use shelled eggs have long been frozen or dried. During World War II enormous quantities of dried eggs were used by the armed forces and by civilians in Britain. Flavor and cooking quality deteriorate during storage, and it is doubtful if eggs in this form will have retail distribution. Both frozen and dried eggs are used largely by bakers and confectioners.

PRINCIPLES OF COOKERY

As soon as eggs come from the market they should be placed in the refrigerator in the carton in which they are packed, unless there is a special compartment for egg storage. Good-quality eggs have clean shells and should not be washed before storage, as washing removes the natural protective coating. Eggs should remain in the refrigerator until just before they are to be cooked, except when they are to form an ingredient of a cake, in which case they will blend better with the batter if they have been allowed to remain at room temperature for some time.

FIG. 95. Poached egg with cheese sauce.

Low temperature and short cooking are desirable for most egg dishes, as the texture will be more delicate and tender under these conditions. For this reason soft-cooked eggs are generally

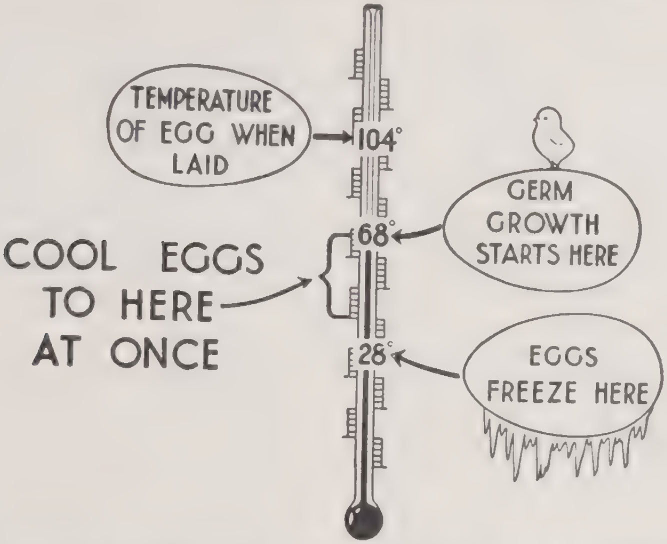


Fig. 96. Critical temperatures of eggs in the shell. (U. S. Department of Agriculture.)

coddled by being allowed to stand in hot rather than boiled water. When eggs are to be hard-cooked for slicing or stuffing, boiling produces a texture which makes them easier to handle. When eggs are to be served hot, they should be prepared just before they are to be served. Coddled eggs in their shells should be placed on the invalid's tray and opened just before they are to be eaten. It is hardly necessary to say that fried eggs have no place in the diet of the sick or the convalescent. The high temperature of the hot fat will necessarily toughen the albumin, and for this reason, also because fat is necessarily taken with the egg, digestion will be retarded.

RECIPES

Coddled Eggs

Procedure: Place 2 cups boiling water in small saucepan and bring again to boiling point. Place 1 or 2 eggs in water. If eggs are not entirely covered, add more boiling water. Remove from heat, cover and let stand where water will remain hot from 6 to 10 minutes, according to degree of firmness preferred by the patient. An allowance of about twice as much time as for boiled eggs must be made for coddled eggs. A 3-minute boiled egg will be about the same firmness as one coddled for 6 minutes. If eggs are taken directly out of the refrigerator, allow 1 extra minute for coddling.

Hard-cooked Eggs

Procedure: Place eggs in saucepan and add cold water to cover entirely. Bring water to boiling point and boil 15 minutes. Drain and cover eggs with cold water. When thoroughly cold remove shell and slice or stuff. Eggs may be hard-cooked by following the recipe for coddled eggs, but allowing the eggs to stand 45 minutes.

Stuffed Eggs

Procedure: Peel hard-cooked eggs and cut in lengthwise halves. Remove yolk and press through small, coarse sieve. Add mayonnaise or cream to moisten. Season to taste with salt, pepper and a few drops of onion juice. A teaspoon of minced ham, minced bacon or a very small amount of anchovy paste may be added. Refill whites with mixture and sprinkle with paprika or minced parsley. Allow 1 egg for each serving.

Poached Eggs

Procedure: Place boiling water to the depth of 1 inch in a frying pan. Add dash of salt. Break each egg into saucer and slip into boiling water. Remove from heat, cover, let stand about 5 minutes (until eggs are firm). Remove from water with pancake turner, allowing water to drain from eggs, and serve on hot buttered toast.

Eggs Poached in Milk

Procedure: Follow preceding directions for poached eggs, substituting hot milk for water. Serve eggs on toast and pour hot milk over them.

Eggs Poached in Butter

Procedure: Place 1 teaspoon butter in a small frying pan and melt over low heat. Break each egg into saucer and slip into frying pan. Remove from heat, cover, let stand about 5 minutes (until eggs are firm). If a harder egg is desired, let stand over low heat 1 more minute.

Poached Egg with Cheese Sauce

Ingredients:

⅛ lb. American cheese
⅛ cup evaporated milk
1 slice toast
1 egg, poached
Salt and pepper to taste

Procedure: Melt the cheese over hot water. Add the milk gradually, stirring constantly. Add seasonings. Pour hot cheese sauce on toast, top with the poached egg.

Plain Omelet

Ingredients:

2 eggs
¼ teaspoon salt
Dash pepper
2 tablespoons milk or water
1 tablespoon butter

Procedure: Beat eggs until very foamy. Add seasonings and liquid. Melt butter in small frying pan and add egg mixture. Place over medium heat and lift edges of omelet as it cooks. Tip frying pan to allow liquid to run under the firm portion. Shake over heat until slightly brown and fold with spatula from handle of frying pan to outer edge. Slip onto a hot plate and garnish with parsley. Yield: 1 serving.

Foamy Omelet

Ingredients:

2 egg yolks
2 tablespoons water
¼ teaspoon salt
Dash pepper
2 egg whites
1 tablespoon butter

Procedure: Beat egg yolks with water and seasonings until very foamy. Beat egg whites until stiff and fold into first mixture. Melt butter in small frying pan, add omelet mixture and shake over low heat until omelet is slightly brown on the bottom. Test by lifting with spatula. Place frying pan in moderate oven (350° F.) about 5 minutes (until omelet is dry on top). Remove from oven and make a shallow cut through center at right angles to handle, fold and slip on to hot plate. Yield: 1 serving.

Scrambled Eggs

Ingredients:

2 eggs
2 tablespoons milk or cream
¼ teaspoon salt
Dash pepper
1 tablespoon butter

Procedure: Beat eggs just enough to mix yolks and whites, stir in milk or cream and seasonings. Melt butter in small frying pan or in top of double boiler. Stir over low heat or hot water as eggs become firm. Stir only enough to prevent eggs sticking to pan. Serve at once. Yield: 1 serving.

Shirred Eggs

Procedure: Butter an individual baking dish and line with soft buttered and seasoned bread crumbs. Break 1 or 2 eggs carefully into dish and sprinkle with salt and pepper. Add 1 tablespoon cream, cover with buttered soft bread crumbs and bake in moderate oven (375° F.) about 15 minutes (until eggs are firm). Yield: 1 serving.

Baked Eggs with Cheese

Procedure: Break 1 or 2 eggs into a small, shallow, greased baking dish. Sprinkle with salt and pepper and cover with grated cheese. Add top milk just to cover eggs and bake in moderate oven (375° F.) about 15 minutes (until eggs are firm). Yield: 1 serving.

Baked Eggs Espagnole

Procedure: Break 1 or 2 eggs into a small, shallow, greased baking dish. Sprinkle with minced onion and mined green pepper. Add condensed tomato soup just to cover eggs and bake in a moderate oven (375° F.) about 15 minutes (until eggs are firm). Yield: 1 serving.

Baked Eggs, Savory

Procedure: Break 1 or 2 eggs into a small, shallow, greased baking dish. Sprinkle with minced ham. Cover with buttered soft crumbs and bake in a moderate oven (375° F.) about 15 minutes (until eggs are firm). Yield: 1 serving.

Baked Eggs with Spinach

Procedure: Line a small, shallow, greased baking dish with well-seasoned chopped cooked spinach. Break 1 or 2 eggs on the spinach. Sprinkle with salt and pepper, and minced onion if desired. Add top milk just to cover eggs and bake in moderate oven (375° F.) about 15 minutes (until eggs are firm). Yield: 1 serving.

Creamed Eggs

Ingredients:

1 tablespoon butter
1½ teaspoons flour
¼ teaspoon salt
Dash pepper
½ cup milk
1 hard-cooked egg

Procedure: Melt butter in small saucepan, add flour and seasonings, stir until smooth. Stir in milk slowly and cook over low heat, stirring constantly until sauce thickens and boils. Shell and slice hard-cooked egg, add to hot sauce, reheat and pour over slice of buttered toast. Garnish with minced parsley. Yield: 1 serving.

Note: A dash of Worcestershire sauce or 1 teaspoon of catsup may be added to the cream sauce after it has thickened.

REVIEW QUESTIONS

1. Compare the food value of eggs with that of milk and meat.
2. Discuss the digestibility of eggs.
3. Outline the principles of egg cookery.
4. List a few simple recipes for cooking eggs suitable for use in the early stages of convalescence.
5. Suggest several methods of treatment by which eggs may be made more interesting on the menu.

43

Desserts

Chapter Topics

FUNCTIONS OF DESSERTS
GENERAL RULES FOR SERVING
RECIPES
  FRUIT DESSERTS
  CUSTARDS AND PUDDINGS
  GELATIN DESSERTS
RECIPES (CONT.)
  FROZEN DESSERTS
  SAUCES
  HIGH CALORIC AND HIGH PROTEIN DESSERTS
  DIABETIC DESSERTS
  ALLERGY DESSERTS

"The mission of dessert is being that of a comforter of the stomach, which being already appeased, nevertheless requires a little reflex flattery," says Elwanger in his "Pleasures of the Table." This mission is perhaps more important in the menu of the convalescent than any other.

FUNCTIONS OF DESSERTS

Desserts have several functions, however, in the invalid's diet. Perhaps the first is the satisfaction that most people feel in having an attractive sweet at the end of a meal. At the same time, it is often possible to supply nutrients particularly needed by a patient in a form to tempt appetite. When it is necessary to increase caloric content of the diet, desserts may be counted upon to furnish this in the concentrated and yet digestible form. When extra protein is indicated, desserts containing milk and eggs are valuable. The protein content may be increased to a larger extent by using milk in a concentrated form, by doubling the number of eggs in a recipe and by using special protein concentrates. When calories must be kept low or when there is any reason for increasing the vitamin C content, fresh fruits, especially of the citrus type, are generally the best choice for dessert. For the preparation of fresh fruits see Chapter 41.

Desserts fall into several general categories, which, however, overlap in many cases. For instance, simple combinations of milk and eggs are known as custards. When the same ingredients are thickened with gelatin, they fall into the classification of gelatin desserts. When thickened with a cereal such as cornstarch or flour, or when combined with bread, they are usually known as puddings.

Frozen desserts are generally acceptable, and are valuable because they are both refreshing and nourishing. As good-quality ice cream and ices are commonly available in manufactured form, they will seldom be prepared in

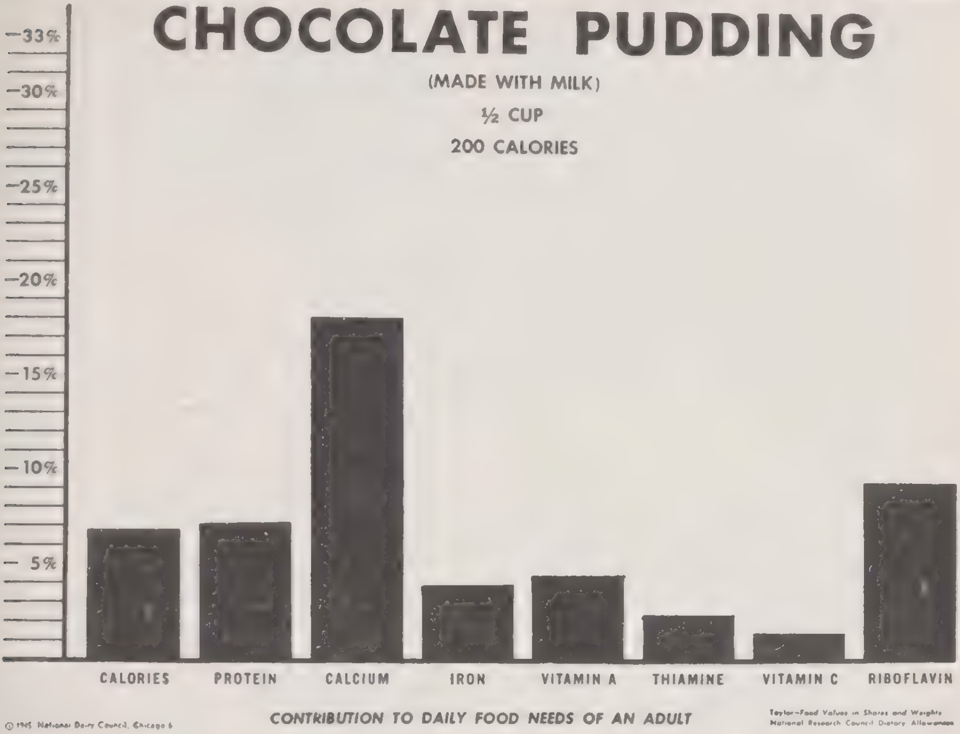


Fig. 97.

the home. Recipes for a few frozen desserts which can be frozen satisfactorily in the automatic refrigerator are included in this chapter.

Also included are suggestions for increasing the caloric and the protein content of recipes and directions for the preparation of desserts suitable for diabetic and allergic patients.

GENERAL RULES FOR SERVING DESSERTS

Desserts for the invalid must as a rule be light and easy to digest. Fruits, custards, gelatin desserts and ice cream may all appear on the invalid's tray, but there is seldom any reason for serving rich puddings and pies.

Small portions are usually more acceptable than large ones, as, when appetite is poor, the very sight of a large portion may be unappetizing.

Serving dishes for desserts should be carefully chosen. Plates for cold desserts should be chilled and for hot ones should be warmed.

Garnishes for desserts should be simple and of contrasting color.

RECIPES

Fruit Desserts

Classified under fruit desserts are whips, soufflés and creams, which are combinations of strained fruit pulp with eggs or whipped cream, and baked fruit puddings for which sliced fruit is combined with bread. The desserts in the first group are light; in the second, heavier.

Fruit Whips. A fruit whip is a combination of beaten egg white and sweetened fruit pulp. Stewed prunes or apricots, applesauce or fresh strawberries, raspberries or peaches may be used. The amount of fruit necessary for a whip will vary with the amount of juice combined with the pulp. The final product should be stiff enough to hold its shape and should be served in a sherbet glass. A custard sauce or whipped cream may be served with a whip.

Basic Recipe for Fruit Whip

Ingredients:

1 egg white
Dash salt
2 tablespoons sugar
¼ cup strained cooked fruit pulp or ½ cup strawberries or raspberries, crushed and sugared
1 teaspoon lemon juice

Procedure: Beat egg white with salt until stiff, add sugar, fold in fruit pulp and lemon juice. Add more sugar, if necessary, and pile in sherbet glasses. Yield: 2 servings.

Fruit Soufflé

Procedure: Follow directions for fruit whip, using strained cooked or canned apricot or prune pulp. Place in greased custard cups, set in pan of hot water and bake in moderate oven (350° F.) about 30 minutes. Yield: 2 small servings or 1 large serving.

Note: If a pint double boiler is available, the soufflé may be steamed for 1 hour in the buttered top, which should be tightly covered.

Lemon Cream

Ingredients:

1 egg
¼ cup sugar
Dash salt
1 tablespoon lemon juice
¼ teaspoon grated lemon rind
1 tablespoon boiling water

Procedure: Place egg yolk, sugar, salt, lemon juice and rind in top of small double boiler. Stir until well blended, add boiling water and stir until sugar is dissolved. Stir over hot water until smooth and thick. Remove from heat, fold in stiffly beaten egg white. Pour into bowl and chill in refrigerator. Just before serving stir and pile in sherbet glass. Yield: 1 liberal serving.

Pineapple Cream

Ingredients:

½ cup boiled rice (p. 440)
2 tablespoons crushed pineapple
¼ cup cream

Procedure: Combine rice with crushed pineapple. Whip cream and fold into rice mixture. Serve in sherbet glass. Yield: 1 liberal serving or 2 small servings.

Baked Rhubarb Pudding

Procedure: Line bottom and sides of small greased baking dish with buttered bread. Fill with alternate layers of diced rhubarb and sugar, cover with slice of bread. Dot with butter. Bake in moderate oven (375° F.) about 25 minutes. Yield: 2 servings.

Note: Sliced apples may replace the rhubarb.

Brown Betty

Ingredients:

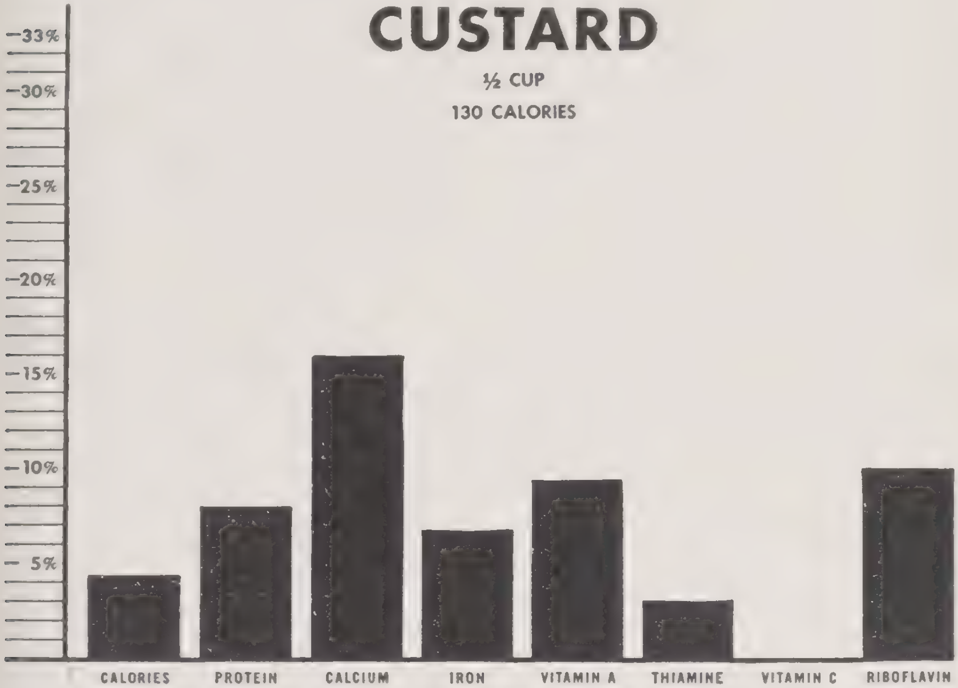
2 slices bread
1 tablespoon butter
1 cup thinly sliced apples
¼ cup sugar
½ teaspoon cinnamon

Procedure: Trim crusts, dice and sauté in butter until lightly browned. Arrange in alternate layers with apples, sugar and cinnamon in small greased baking dish. Cover and bake in moderate oven (375° F.) 20 minutes. Remove cover and bake until brown. Serve hot with cream. Yield: 2 servings.

Custards and Puddings

Custards, which are combinations of eggs and milk, sweetened and flavored, are natural carriers of protein. To further increase this content, see High Protein Recipes on page 470. For texture and flavor they must be baked in hot water or cooked over hot water in a double boiler. Directions must be followed exactly as to length of time to cook, as overcooking will cause some of the ingredients in baked custards to separate or whey.

Desserts usually known as puddings, of which tapioca cream, rice pudding, blanc mange and bread pudding are examples, depend upon a cereal product for extra thickening, although they all contain milk and eggs, the basic ingredients of a custard. Junket, in which milk is thickened by use of a rennet tablet, is sometimes known as a custard, although no eggs are used in its preparation.



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CONTRIBUTION TO DAILY FOOD NEEDS OF AN ADULT

Taylor—Food Values in Shares and Weights
National Research Council Dietary Allowances

Fig. 98

Baked Custard

Ingredients:

1 cup milk
1 egg
1 tablespoon sugar
⅛ teaspoon salt
Nutmeg

Procedure: Scald milk. Beat egg slightly, stir in sugar, salt and milk, continue stirring until sugar is dissolved. Strain and pour into custard cups. Sprinkle with nutmeg and bake in a pan of hot water in moderate oven (375° F.) about 30 minutes. To test: Insert knife into custard. When no custard adheres to knife, take from oven at once and place cups in cold water. Yield: 2 servings.

Note: 2 eggs instead of 1 may be used, if desired. Cooking time will be slightly shorter in this case. Vanilla may be added for flavoring, if desired.

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1 egg
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Dash salt
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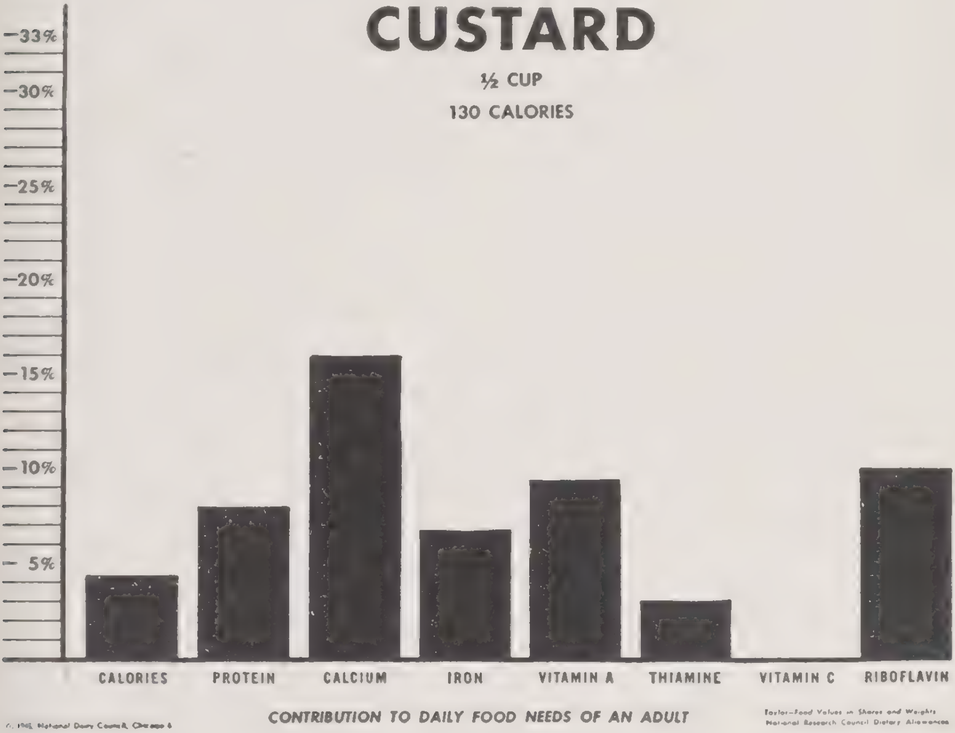

Fig. 98

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Note: 2 eggs instead of 1 may be used, if desired. Cooking time will be slightly shorter in this case. Vanilla may be added for flavoring, if desired.

Caramel Custard

Procedure: Follow directions for baked custard. Before placing custard in cups, butter them liberally and put 1 tablespoon caramel sirup (see below) in the bottom of each cup.

Caramel Sirup

Procedure: Place ¼ cup sugar in small frying pan, stir constantly over low heat until sugar melts and forms a sirup. Add another ¼ cup sugar and continue stirring until dissolved. Add ¼ cup boiling water very carefully and stir over low heat until sirup is smooth. Yield: Approximately ½ cup.

Bread Pudding

Procedure: Follow preceding directions for baked custard. Remove crust from 1 slice buttered bread, cut slice in half and put in the bottom of a small baking dish. Pour custard mixture over bread. Bake according to directions for baked custard. Serve hot or cold. Yield: 2 servings.

Cream Custard

Ingredients:

1 egg white
1 tablespoon sugar
Dash salt
½ cup thin cream
Nutmeg

Procedure: Mix egg white, sugar and salt; add cream and stir until sugar is dissolved and egg white thoroughly mixed with cream. Pour into custard cups, sprinkle with nutmeg and bake according to directions for baked custard. Yield: 2 small servings.

Soft Custard

Ingredients:

1 cup milk
2 egg yolks
2 tablespoons sugar
Dash of salt
¼ teaspoon vanilla

Procedure: Scald milk. Place egg yolks, sugar and salt in top of a small double boiler and stir until blended. Stir in scalded milk slowly and cook over hot water, stirring constantly until the custard when tested coats a metal spoon. Remove at once from hot water and place in cold water to cool quickly. Add vanilla and chill. Serve as dessert with whipped cream, or pour over sliced oranges, berries, stewed pears, boiled rice or sponge cake. Yield: approximately 1¼ cups custard.

Custard Rice Pudding

Procedure: Follow directions for soft custard, increasing amount of sugar to ¼ cup. Have ready ¾ cup boiled or steamed rice and fold into hot custard mixture. Pile into sherbet glasses and sprinkle with grated nutmeg or grated orange rind. Chill before serving.

Note: ¼ cup seedless raisins or drained crushed pineapple may be folded into the rice before being added to the custard.

Fluffy Custard

Ingredients:

1 cup milk
¼ cup sugar
1 tablespoon flour
Dash of salt
2 egg yolks, slightly beaten
2 tablespoons brandy, rum or sherry
2 egg whites, stiffly beaten

Procedure: Scald ¾ cup milk in top of double boiler. Mix sugar, flour and salt, stir into beaten egg yolks. Stir in cold milk to make a smooth paste and stir into scalded milk. Continue stirring over hot water until mixture thickens slightly. Remove from heat and cool slightly. Add flavoring and fold into beaten egg whites. Chill and serve with berries or sliced fruit. Yield: Approximately 1½ cups custard.

Tapioca Cream

Ingredients:

1 tablespoon quick-cooking tapioca
Dash salt
1½ tablespoons sugar
1 egg
1 cup milk
¼ teaspoon vanilla

Procedure: Mix tapioca, salt, sugar and egg yolk in top of small double boiler. Stir in milk gradually and cook over hot water, stirring frequently from 8 to 10 minutes until tapioca is transparent and mixture thickens slightly. Remove from heat. Add vanilla and fold into stiffly beaten egg white. Pour into bowl or sherbet glasses and chill. Yield: 3 servings.

Golden Tapioca

Procedure: Follow preceding directions for tapioca cream, substituting 2 tablespoons brown sugar for 1½ tablespoons sugar.

Blanc Mange

Ingredients:

1 cup milk
1½ tablespoons cornstarch
1 egg yolk, slightly beaten
2½ tablespoons sugar
Dash of salt
½ teaspoon vanilla extract
1 egg white, stiffly beaten

Procedure: Scald ¾ cup milk in top of double boiler. Stir remaining milk into cornstarch to make a smooth paste. Stir into the scalded milk and continue stirring until slightly thickened. Cover and cook over hot water 10 minutes. Combine slightly beaten egg yolk, sugar and salt; stir in the hot mixture slowly. Add vanilla and beat well. Then fold into the stiffly beaten egg white. Pour into molds and chill until firm. Unmold and serve with plain or whipped cream, custard sauce (see Soft Custard, p. 464; Chocolate Sauce, p. 470) or crushed sweetened fruit. Yield: 3 servings.

Chocolate Blanc Mange

Procedure: Follow preceding directions for blanc mange. Add ½ square shaved chocolate to milk before scalding. As chocolate melts, beat with rotary egg beater until completely blended with milk.

Coconut Blanc Mange

Procedure: Follow directions for blanc mange. Fold 2 tablespoons shredded coconut into hot mixture before adding beaten egg white.

Macaroon Blanc Mange

Procedure: Follow directions for blanc mange. Fold 3-4 broken macaroons into mixture before adding beaten egg white.

Junket

Ingredients:

½ junket tablet
½ tablespoon cold water
1 cup milk
1 tablespoon sugar
¼ teaspoon vanilla

Procedure: Crush junket tablet and dissolve in cold water. Heat milk until lukewarm. Add sugar and vanilla, stir until dissolved. Stir in dissolved junket and pour at once into individual serving dishes. Let stand in a warm place until set. Chill and serve with a bright red jelly or whipped cream. Junket custards are now available in package form. Yield: 2 servings.

PREPARED PUDDINGS

Many prepared mixes for puddings and frozen desserts are now available for purchase. These come in a variety of flavors and call for the addition of milk or water and short cooking or a period of freezing time in the automatic refrigerator. Many of them compare favorably with desserts prepared by a home recipe. They will often be found convenient by the nurse who has many other duties besides preparing and serving meals for her patients.

GELATIN DESSERTS

Gelatin desserts serve several purposes in the invalid's diet. Clear jellies are refreshing and may serve as a medium for the use of extra fruit juice when this is indicated. Jellied desserts made with eggs and milk will be a medium for increasing the protein content of the diet.

GENERAL DIRECTIONS FOR GELATIN DESSERTS

Unflavored gelatin should be softened in cold water, then dissolved in hot liquid or over hot water. The contents of one envelope of unflavored gelatin equal one tablespoon. Flavored gelatin should be prepared according to directions on package. It should be noted that fresh pineapple cannot be used in gelatin mixtures, although canned pineapple juice and fruit can be used successfully. Gelatin desserts are usually poured into molds and cooled somewhat before being placed in the refrigerator. The jelly will set completely in small molds in about 2 hours. It is not necessary to rinse the molds with water.

To unmold gelatin: Set mold in lukewarm water 1 minute. Loosen edge of dessert with sharp knife. Wipe bottom of mold, place serving plate over mold and invert, shaking gently. If dessert does not loosen, return to lukewarm water for ½ minute.

When a jellied mixture is used as a base for fruit jellies and desserts made with milk and eggs, it should be chilled in the refrigerator until it begins to set; that is, when the consistency is somewhat like that of a thick sirup or an unbeaten egg white. After the remaining ingredients are added, the mixture is poured into a mold and placed in the refrigerator until firm.

Lemon Jelly

Ingredients:

½ tablespoon unflavored gelatin
2 tablespoons cold water
¼ cup boiling water
3 tablespoons sugar
½ cup cold water
¼ cup lemon juice

Procedure: Soften gelatin in cold water, add boiling water and stir until dissolved. Add sugar, stir until dissolved, add cold water and lemon juice. Strain and pour into molds. Chill in refrigerator until set and unmold according to general directions. Yield: 2 servings.

Snow Pudding

Procedure: Follow directions for lemon jelly. Chill until mixture begins to set. Beat until frothy. Add stiffly beaten egg white, continue beating until stiff enough to hold its shape. Chill and serve with custard sauce (see Soft Custard, p. 464).

Fruit Snow Pudding

Procedure: Fill sherbet glasses one third full of snow pudding mixture. Arrange sections of peeled ripe pears or peaches on this and top with more of the pudding mixture.

Orange Jelly

Procedure: Follow preceding directions for lemon jelly, substituting ¼ cup orange juice for 3 tablespoons lemon juice.

Orange Charlotte

Procedure: Follow directions for orange jelly. Chill in refrigerator until jelly begins to set. Beat with rotary beater until frothy. Whip ¼ cup cream and fold into mixture. Pour into mold or sherbet glasses and place in refrigerator until firm.

Note: One stiffly beaten egg white may replace the whipped cream.

Jellied Fruit

Procedure: Follow directions for lemon jelly (above), reducing lemon juice to 2 tablespoons. Chill until jelly begins to set. Fold in ½ cup sliced fruit such as peaches, bananas, strawberries, raspberries, cut orange or grapefruit sections, stewed or canned apricots, prunes, canned peaches or pineapple. Not more than 3 fruits are usually combined.

FIG. 99. Fruit snow pudding ready to serve.

Coffee Jelly

Ingredients:

½ tablespoon unflavored gelatin
2 tablespoons cold water
1 cup strong hot coffee
¼ cup sugar
Dash salt

Procedure: Soften gelatin in cold water; add hot, freshly made coffee, sugar and salt; stir until dissolved. Pour into molds, chill until set. Unmold. Garnish with whipped cream. Yield: 2 servings.

Coffee Charlotte

Procedure: Follow directions for coffee jelly and finish preparation according to directions for Orange Charlotte.

Wine Jelly

Ingredients:

½ tablespoon unflavored gelatin
2 tablespoons cold water
¼ cup boiling water
3 tablespoons sugar
¼ cup orange juice
1 tablespoon lemon juice
¼ cup sherry wine

Procedure: Soften gelatin in cold water, add boiling water and stir until dissolved. Add sugar, fruit juices and wine. Strain and pour into molds. Chill until set. Unmold and garnish with whipped cream. Yield: 2 servings.

Spanish Cream

Ingredients:

1 cup milk
½ tablespoon unflavored gelatin
2 tablespoons cold water
1 egg
2 tablespoons sugar
Dash salt
½ teaspoon vanilla extract

Procedure: Scald milk. Soften gelatin in cold water and dissolve with scalded milk. Beat egg with sugar and salt, stir the hot mixture into this. Place in small double boiler and stir over hot water until mixture thickens slightly. Add vanilla extract and chill until mixture begins to set. Fold in stiffly beaten egg white and pour into bowl or sherbet glasses. Serve with whipped cream or sweetened crushed fruit. Yield: 3 servings.

Bavarian Cream

Procedure: Follow preceding directions for Spanish cream, substituting ¼ cup whipped cream for the stiffly beaten egg white.

Caramel Spanish Cream

Procedure: Follow directions for Spanish cream, substituting ¼ cup brown sugar, firmly packed, for 2 tablespoons sugar. The unmolded dessert may be garnished with whipped cream and toasted almonds, if desired. Undiluted evaporated milk may be substituted for the milk.

Mocha Spanish Cream

Procedure: Follow directions for Spanish cream. Scald ¼ cup ground coffee with the milk and strain through cheesecloth before adding to gelatin. Increase sugar to 3 tablespoons. Undiluted evaporated milk may be substituted for the milk.

Molasses Mousse

Ingredients:

½ tablespoon granulated gelatin
2 tablespoons cold water
¾ cup (7 oz. can) undiluted evaporated milk
¼ cup molasses
1 teaspoon grated orange rind
2 teaspoons orange juice

Procedure: Soften gelatin in cold water. Scald half the milk, add to gelatin and stir until dissolved. Add molasses, orange

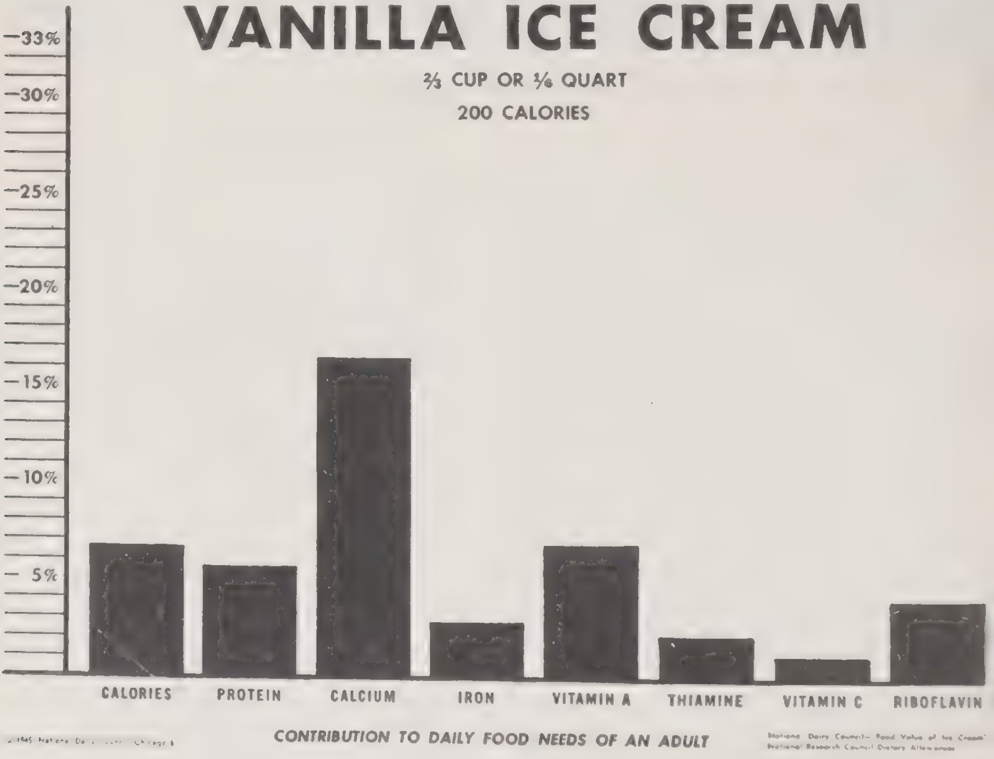

Fig. 100.

rind and juice, chill until mixture begins to set. Whip remaining milk, which has been chilled several hours, and fold into gelatin mixture. Pour into molds and chill until set. Yield: 3 servings.

FROZEN DESSERTS

Frozen desserts play an important part in the invalid's diet. Almost everyone likes ice cream and fruit ice, which are generally allowed in the liquid as well as in the lighter convalescent diets. It will almost never be necessary for the nurse to prepare a frozen dessert, as both ice cream and fruit ice can be purchased at every corner drugstore and confectionery store. Naturally, only good-quality ice cream known to be made under sanitary conditions should be used. If it should ever be necessary for the nurse to make "turned" ice cream or to supervise its preparation, a standard cookbook should be consulted. If made especially for the invalid, a pint freezer should be used. Acceptable desserts may also be frozen in the tray of the automatic refrigerator.

Ice Cream. If ice cream has been purchased near by and is not to be used immediately, it should be placed in the tray of the freezing compartment in the refrigerator. An exception should be made of ice cream packed in dry ice, which should be unpacked and allowed to soften slightly at room temperature.

FIG. 101. Ice cream may be attractively served in a glass dish.

Ice cream may be piled in a chilled sherbet glass or on a chilled plate. Vanilla ice cream may be varied by garnishing with sweet crushed fruit, such as strawberries, raspberries or peaches, or by using a chocolate sauce or butterscotch sauce (p. 470).

Refrigerator Desserts. Special recipes are necessary for desserts which are to be frozen in an automatic refrigerator. As the tray in the freezing compartment is generally one-quart size, these desserts cannot be prepared satisfactorily in very small quantities. Bases especially designed for frozen dishes can be purchased or the following recipes may be used.

Vanilla Ice Cream (Automatic Refrigerator)

Ingredients:

⅔ cup (7½ oz. can) sweetened condensed milk
½ cup water
1½ teaspoons vanilla
1 cup heavy cream

Procedure: Mix sweetened condensed milk, water and vanilla. Chill. Whip cream to custard-like consistency. Fold into chilled mixture. Freeze in freezing unit of refrigerator until half frozen. Scrape from freezing tray. Beat until smooth but not melted. Replace in freezing unit until frozen. (Total time of freezing, from 2 to 4 hours.) Yield: 1½ pints.

Chocolate Ice Cream

Procedure: Follow preceding directions for vanilla ice cream. Add 1 square chocolate, cut in pieces, to milk and water, and heat over hot water, beating with rotary egg beater to blend well. Cool before adding remaining ingredients.

Coffee Ice Cream

Procedure: Follow directions for vanilla ice cream (above), substituting strong coffee for water. Decrease vanilla to ½ teaspoon.

Orange Ice Cream

Procedure: Follow preceding directions for vanilla ice cream (above), substituting orange juice for water and ½ teaspoon grated orange rind for the vanilla.

SAUCES

Butterscotch Sauce

Ingredients:

1 egg yolk
½ cup brown sugar, firmly packed
1 tablespoon water
1 tablespoon butter

Procedure: Combine ingredients in top of small double boiler and mix thoroughly. Place over boiling water and stir until thick and smooth. Serve hot or cold. Beat well before serving. Yield: 3 servings.

Chocolate Sauce

Ingredients:

½ square chocolate
½ cup water
½ cup sugar
Dash salt
½ teaspoon vanilla extract
1 teaspoon butter

Procedure: Cut chocolate in pieces and place in small saucepan, add water and stir over low heat until smooth and thick. Add sugar and salt, stir until dissolved. Boil 2 minutes, add vanilla extract and butter. Serve hot over ice cream, sponge cake or angel food. A ball of ice creeam may be served with the cake. Yield: 3 servings.

Quick Chocolate Sauce

Procedure: Cut in small pieces half of a ¼-lb. bar milk chocolate into a small saucepan and stir over hot water until chocolate is melted.

HIGH CALORIC AND HIGH PROTEIN DESSERTS

Any recipe in any of the various classifications which contains milk or milk and eggs may easily be adjusted to furnish extra calories and proteins. A simple method of increasing the calories is to use lactose in addition to the sugar. To increase the protein content and at the same time the calories, undiluted evaporated milk may replace the fresh milk, or one tablespoon of dry milk may be beaten into the fresh milk. The eggs in any recipe may be doubled.

Another simple method for increasing the protein content is to make use of the protein hydrolysates which are manufactured by a number of drug and chemical companies. Suggestions for the addition of these will be found in the pamphlets which accompany the products. For the names of some of these high protein concentrates see Chapter 37 (Beverages).

High Caloric Custard

Ingredients:

2 tablespoons sugar
4 tablespoons lactose
1 cup thin cream
1 egg
⅛ teaspoon salt
¼ teaspoon vanilla
Nutmeg

Procedure: Add sugar and lactose to cream, heat to boiling to dissolve the sugars. Cool slightly. Beat egg, add salt and vanilla, stir into cream mixture. Sprinkle with nutmeg. Bake according to directions for baked custard (p. 463). Yield: 2 servings.

High Protein Custard

Procedure: In above recipe substitute milk for cream and increase eggs to 2.

Diabetic Desserts

Junket

Procedure: Crush ½ junket tablet and 1 (¼ grain) saccharin tablet with a spoon in a cup; add 1 tablespoon cold water, 2 drops vanilla and dissolve. Heat 1 cup milk until it is only lukewarm. Add to dissolved tablet and do not move the cup until junket is firm (about 20 min.). Then chill in cold place.

Value: C10 P6 F8.

Use recipe if 1 glass of milk is allowed on diet. Use half recipe if ½ glass milk is allowed on diet. Junket tablet has no value. Cellu junket powder has no value.

Fruit Whip

Procedure: Beat one egg white until stiff, sweeten with saccharin. Add few drops of lemon juice. Fold in one of the following:

4 halves strained apricots
½ raw apple, scraped
⅓ cup applesauce
1 small cooked peach, strained
1 small scraped raw peach
2 strained prunes
½ banana, mashed

Value of the fruit whip without the egg yolk: C10 P5 F0.

Custards

Procedure: Substitute 1 (¼ grain) saccharin tablet for sugar in recipe for baked custard and soft custard, p. 463.

Value: C10 P13 F14.

Fruit Juice Gelatin

Procedure: Dissolve 1 level teaspoon of unflavored gelatin in 2 tablespoons cold water. Add ½ cup boiling water to dissolve gelatin; add the juice of the fruit allowed on the diet for one meal, 1 teaspoon lemon juice if desired and 1 (¼ grain) saccharin tablet. Set in a cool place to harden.

Lemon Gelatin with Fruit

Procedure: Use recipe above with lemon juice only and add sliced orange or banana. (Fruit portion for one meal.)

Allergy Desserts

Recipes for desserts for allergic patients must be chosen after checking the ingredients in the recipes. In some cases, there may be an allergy toward fresh milk but not toward evaporated or dried milk, either of which may be substituted after dilution according to the directions which come on the can or package. For recipes for cake and cookies which may function as desserts for the allergic patient, see Chapter 50, "Breads, Batter and Doughs."

REVIEW QUESTIONS

1. Desserts can play an important place in the invalid's diet. For what reasons?

2. A dessert should be light and easy to digest. Which classes of desserts will fill these requirements?

3. Fruit desserts should be appetizing and easy to digest. Discuss these factors.

4. Gelatin may be used advantageously in the preparation of desserts. With what other foods is it often combined? What are the basic rules for the preparation of a gelatin dessert?

5. Custards are excellent desserts. Explain this statement.

6. Ice cream is the standard dessert in the diet for a convalescent. For what reasons?

7. Special thought must be given to desserts for an allergic patient. With reference to this chapter and to Chapter 50, select desserts appropriate for a patient allergic to eggs; allergic to both milk and eggs.

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Cheese

Chapter Topics

- TYPES OF CHEESE
- AVERAGE COMPOSITION OF SOME COMMON VARIETIES OF CHEESE
- FOOD VALUE
- DIGESTIBILITY
- USE OF CHEESE IN THE MENU
- PRINCIPLES OF COOKERY
- RECIPES

The general term cheese is applied to any product made from the concentrated curd of milk. Cheese is considered to be the first manufactured food, the process for which was probably discovered accidentally when milk was stored in a bag made from the stomach of a cow, which contains rennin. The action of rennin upon milk causes the curds and the whey to separate. While a certain amount of the milk nutrients remain in the whey, the majority remains in the curd, which provides a large amount of the natural food value in milk in concentrated form.

Both food value and flavor of the many types of cheese which are available today depend upon the percentage composition and the methods of ripening which are used in production. The ancient rennet method is still used in modern cheese manufacture for some types of cheese, while for others the curd and the whey are separated by means of lactic acid through adding pure cultures of bacteria to the milk. While a very small amount of cheese is made in Europe from the milk of sheep and goats, cows' milk is the basis for the great majority of both domestic and foreign types of cheese.

TYPES OF CHEESE

Cheese until comparatively recent times, due perhaps to the abundance of meat in the United States, was used more as an accessory than as a staple food.

Cheddar cheese, known generally as store cheese, was the only commonly used commercial type, although there was always home production of cottage cheese. Now, however, the manufacture of cheese and cheese spreads has become a large commercial industry. Much of the cheese of the Cheddar type used in the United States today is processed and packaged. The processing, which includes pasteurization, produces a standard product. However, it lacks the pungent and the individual flavor of a fine Cheddar cheese prepared and allowed to ripen naturally. Some processed cheese is offered in the form of a spread to which whey, skimmed milk or butter fat has been added.

Cottage cheese, made from pasteurized skim milk, is next in order of consumption to Cheddar cheese. Because of the lack of fat, the caloric value is much lower than that of Cheddar. Some of the calcium is lost in the process of manufacture, but it is still a good source of this mineral. The manufacture and the use of cottage cheese are important from the nutrition standpoint, use being made of skimmed milk remaining from the manufacture of butter and cream which would otherwise be lost.

Cream cheese, which, like cottage cheese, is not ripened and is, therefore, also a perishable product, is made from whole milk with a certain amount of cream added, which gives it a higher caloric value.

Luxury Cheeses. Other varieties of cheese, sometimes known as luxury or epicurean cheeses, are used more as an accessory to a meal than as a staple part of it. They account for not more than one eighth of the cheese production in the United States. Most of them are known by the names of famous European cheeses, many of which were imported before the war. Of the 400 or more varieties found in Europe, about a dozen or so have been duplicated with some success by American manufacturers. The same titles are used with the addition of the word type to indicate the individual characteristics. The imported cheeses and the American products fall into two general classifications characterized by hard or soft texture. In the following table of average composition, the three classifications of soft, semihard and hard are used.

AVERAGE COMPOSITION OF SOME COMMON VARIETIES OF CHEESE

	Water	Prot.	Fat	Carb.	Calories per 100 Gm.	Calories per Lb.
Soft:						
Camembert, Imported	48	22	26	..	322	1,462
Cottage	70	19	1	4	101	459
Cream (Neufchâtel)	59	7	37	2	369	1,675
Brie, Imported	53	21	22	..	282	1,280
Liederkranz	..	16	26	1	298	1,353
Limburger, American	36	29	30	..	386	1,752
Semihard:						
Brick, American	43	21	31	..	363	1,648
Gorgonzola	34	26	33	1	401	1,821
Münster, American	41	22	31	..	367	1,656
Roquefort	39	22	33	1	389	1,766
Stilton	34	29	31	..	395	1,793
Hard:						
Cheddar, American	36	24	32	2	392	1,780
Edam	34	24	34	6	426	1,934
Gouda	..	24	34	6	426	1,934
Gruyère	..	29	31	2	403	1,830
Parmesan	30	35	27	..	383	1,739
Pineapple	24	29	38	3	470	2,134
Swiss (Emmentaler cheese)	34	29	31	2	403	1,830

FOOD VALUE

As has been stated in a previous chapter, milk is the best single food provided by nature. Lost in the process of the manufacture of cheese are a small amount of the protein content, a portion of the milk sugar, certain mineral salts and some of the water-soluble vitamins. However, the retention of the large amount of protein and fat, the calcium and the phosphorus, the vitamin A and the riboflavin makes cheese a most valuable food. The distinctive flavor characteristic of ripened cheese and its high protein content make it an unusually acceptable meat substitute. According to the softness or hardness, the food value will vary inversely with the water content, as is illustrated by the table "Average Composition of Some Varieties of Cheese" on page 474. It will be noted that American Cheddar cheese, the type most commonly used in cooking and as an accessory, scores well on the list.

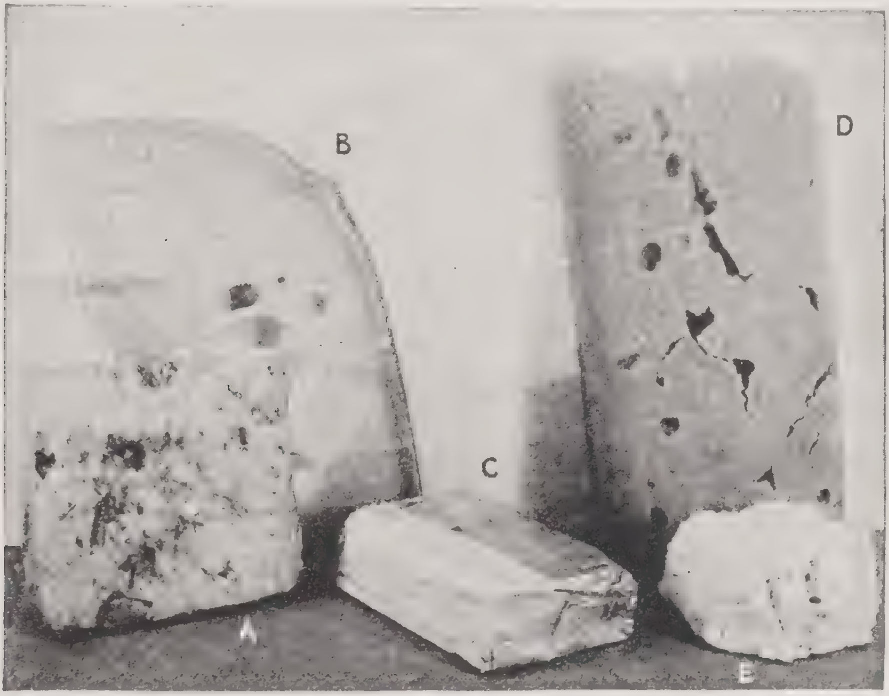

FIG. 102. Five common cheeses, with differences in texture (gas) and color due to micro-organisms: blue molds in Roquefort cheese, A, and gas-forming bacteria in Swiss, B, and creamery cheese, D. C is cream cheese. E is cottage cheese.

DIGESTIBILITY

In general, cheese is easily digested. However, the high fat content and the strong flavor of ripened cheese make it unsuitable in some conditions for use on the invalid's tray. Cottage and cream cheeses, because of their lower degree of concentration and milder flavor, can generally be used early in convalescence. Later, Cheddar cheese may be used in combination with other foods as an ingredient for a main dish or as a filling for a sandwich. One of the finer types of cheese accompanied by crackers may serve as a dessert. The serving of crackers or bread with cheese is good nutritional practice. The reputation for indigestibility which cheese has acquired is due to the habit of eating it in too large quantities at one time unaccompanied by other less highly flavored and less concentrated foods, or to taking it after a heavy meal. The favorite American dessert of pie with cheese is more appropriate after a light meal than a heavy one.

USE OF CHEESE IN THE MENU

Until recently, little use was made of cheese as an ingredient or as the basis of the main dish for a meal. American cheese, sliced for use as a sandwich filling and cut in wedges for serving with pie, and cottage cheese as an accessory to the main course appeared occasionally on the table. Grated American cheese had some use as a flavoring for sauces, for macaroni and other foods, and as a topping for certain creamed dishes. In some households it was used occasionally as a "rabbit."

The increased availability of variations of the Cheddar type of cheese, sold by the package, by the pound or in spread form, each with its own distinctive name and flavor, has stimulated the use of cheese on the table. Cottage and cream cheese, especially the former, also are used largely, often with green salads or as a stuffing for celery. Cottage cheese has some use also as an ingredient of a few cooked dishes.

Both because they are expensive and because most of them have such distinctive flavor, the fine "luxury" types of cheese are reserved as a general rule for serving after meals, although occasionally they appear with salads. For a special salad dressing Roquefort cheese is a favorite ingredient.

PRINCIPLES OF COOKERY

When cheese is used in cooking it is usually grated or finely flaked, or, if soft, it is pressed through a strainer. When grated cheese is indicated in a recipe, sieved cheese may be substituted. For top-of-stove cooking, it is generally best to use a double boiler and to cook the cheese over hot water. For baked cheese dishes, a low temperature is generally used, and sometimes directions call for placing the dish containing the cheese mixture in a pan of hot water.

When a high temperature is used, as for instance in toasting an open cheese sandwich under the broiler, the cooking period should be short. The texture of cheese will toughen when it is overcooked by any method.

RECIPES

Cheese Soufflé

Ingredients:

2 tablespoons butter or margarine
2 tablespoons flour
¾ cup milk
½ teaspoon salt
¼ lb. (1 cup) American cheese, flaked
3 eggs

Procedure: Melt butter or margarine in a small saucepan. Stir in flour and salt; when smooth, stir in milk gradually. Continue stirring until sauce thickens and boils. Remove from heat, add cheese and stir until melted. Stir in egg yolks one at a time, beating after each addition. Fold into the stiffly beaten egg whites. Pour into greased 1 quart casserole and bake 1 hour in a slow oven (300° F.). Yield: 3 servings.

Fig. 103. Toasted cheese sandwich with rabbit sauce.

Fig. 104. Cheese soufflé.

Cheese Fondue

Ingredients:

- ⅓ cup milk
- ⅓ cup soft bread crumbs
- ¼ teaspoon salt
- ½ cup grated cheese
- 1 egg yolk, unbeaten
- 1 egg white, stiffly beaten

Procedure: Combine milk, bread crumbs and salt. Cook over low heat, stirring with a fork until mixture is smooth and bubbling. Remove from heat, add cheese and stir until well blended. Beat in unbeaten egg yolk. Fold in stiffly beaten egg white. Bake in greased 1 pint baking dish in moderate oven (350° F.) until golden brown (about 25 minutes). Yield: 2 servings.

Toasted Cheese

Ingredients:

- ½ cup flaked cheese
- ⅛ teaspoon salt
- ⅓ teaspoon paprika
- 1 egg
- ½ cup milk

Procedure: Grease thoroughly a small pie pan or 4-inch au gratin dish. Grate cheese directly into baking dish. Add seasonings. Break egg over cheese, add milk and mix with a fork. Place in pan of hot water and bake in a moderate oven (375° F.) until set (about 15 to 20 minutes). Yield: 1 serving.

Note: ⅛ teaspoon mustard may be added.

Luncheon or Supper Dishes

Welsh Rabbit

Ingredients:

- 1 egg
- ¼ teaspoon salt
- ⅛ teaspoon paprika
- 2 tablespoons milk
- ½ cup grated cheese

Procedure: Break egg into top of small double boiler or small saucepan. Beat until foamy, stir in other ingredients and cook over hot water, stirring constantly until smooth and thick. Pour over toast and serve at once. Yield: 1 serving.

Tomato Rabbit

Ingredients:

- ½ cup grated cheese
- ½ cup condensed tomato soup

Procedure: Combine cheese and tomato soup in top of small double boiler or small saucepan. Stir over hot water until mixture is smooth and thick. Pour over toast and serve at once. Yield: 1 serving.

Note: This recipe may be used as a sauce for toasted cheese sandwich.

For other recipes using cheese, see Chapter 40 (Cereals, Macaroni, Noodle and Rice Recipes) and Chapter 50 (Breads, Toast and Sandwich Recipes).

REVIEW QUESTIONS

1. List the types of cheese most commonly used. List the types of cheese which you have eaten.
2. Compare the food value of milk with cheese.
3. Give the reasons why cheese is considered a good meat substitute.
4. Discuss the digestibility of cheese. Why is it better to use cheese with bread or crackers?
5. Outline the principles of cheese cookery.

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Meats and Poultry

Chapter Topics

TRENDS IN MEAT CONSUMPTION	GENERAL PRINCIPLES OF COOKERY
SAFE MEAT	EFFECT OF COOKING ON FOOD VALUE
TYPES OF MEAT	CARE AND PREPARATION OF MEAT
TYPES OF POULTRY	MEAT RECIPES
FOOD VALUE	CHOICE AND PREPARATION OF POULTRY
DIGESTIBILITY	POULTRY RECIPES
MEAT AND POULTRY IN THE MENU	BROTHS, SOUPS AND JUICES

The term meat may be used in the larger sense to include poultry as well as beef, veal, lamb, mutton and pork, the flesh of large animals. The custom of the country gives some form of meat a place on the table daily, and although it does not appear three times a day, as was the case a generation ago, it is an important factor in the menu of most American families.

TRENDS IN MEAT CONSUMPTION

The consumption of meat has been comparatively heavy in the United States, although far less so than in pioneering days. Finding meat abundant and cheap, the settlers of the new lands made it a large part of their diet, to which it added savor as well as bulk. There was then of course a smaller variety of other foods available than at present. The rising costs of meats and the increased variety of other foods available in the markets have changed the emphasis on meat as a preponderant part of the diet. The reaction from the custom of eating meat at every meal lowered the consumption markedly and resulted in its being considered by some a luxury rather than a necessity. However, the experimental work of the past years has shown that it is difficult to obtain an adequate amount of protein of high quality without the use of a substantial amount of meat in the daily diet. As shown in Figure 105, there is no significant difference in the protein content of various types of meat.

SAFE MEAT

Because meat is a protein food, special precautions must be used in slaughtering, in storing and in shipping. Because meat is often transported long distances, the Federal Government can enforce rigid inspection of the large meat companies which conduct interstate business. Local authorities should do the same in the case of regional meat supplies.

Modern methods for the initial cooling of meat after slaughtering and for cold storage make it possible for meat to "hang" long enough to become tender. Tenderness depends upon this period of hanging, as well as upon the age of the cattle and upon the way in which they were fed. The importance of the careful handling and refrigeration of meat cannot be overestimated, for very high bacterial counts have been reported for such meat products as sausages and hamburger, sometimes exceeding 1,000,000 bacteria per gram, especially where the meat is carelessly handled (soiled hands, dirty meat grinder, etc.) and is allowed to stand at room temperatures. (See Chap. 14.) For special precautions with regard to ensuring the safety of pork through long cooking and the reason for this necessity, see page 489.

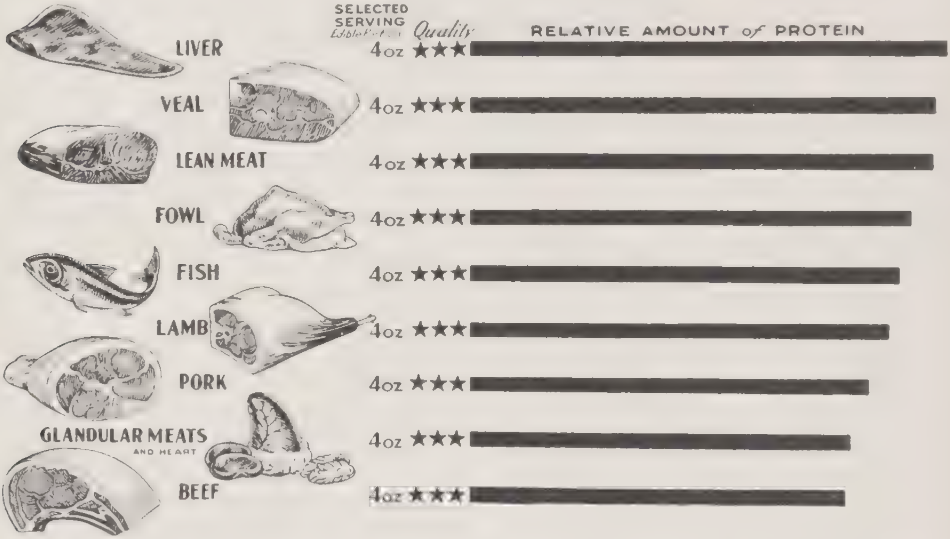


Fig. 105. Relative amounts of protein in 4-oz. servings. (National Livestock and Meat Board, Chicago.)

Frozen meats, for which various cuts are trimmed and made ready for cooking, are now available in packaged form. They should be allowed to thaw at room temperature before cooking, but if not to be used the same day, should be stored in the freezing compartment of the refrigerator.

Meat in general should be stored loosely covered with paper in the refrigerator as soon as it comes from market. Ground meat and organs such as liver and kidneys which are highly perishable should be put in the freezing compartment if not to be used within a few hours. While cooked meat is less subject to spoilage than raw meat, leftovers should be used as soon as possible.

TYPES OF MEAT

Beef

Beef, coming as it does from such a large animal, varies greatly in its texture, and this means that special care must be taken in choosing cuts suitable for various purposes. The more tender portions, such as the loin, the round and the ribs, are used for broiling and roasting, while the rump and the plate make excellent stews. The bony portions, such as the shin and the shoulder, with their high flavors are best for soups.

When beef is used for invalids, a small club steak, a "minute" steak, thinly sliced from the round, or a piece of the tenderloin, or fillet as it is called, is usually chosen if special cooking is possible.

Beef, unlike other meats, when broiled or roasted is usually served rather rare.

VEAL

Veal is the meat of a young calf not less than three weeks old at the time of slaughter. The best veal comes from milk-fed calves from six to eight weeks old. "Bob" veal, or veal that is less than three weeks old, is often soft and of poor flavor, and its sale is prohibited in many states, though experiments at the New York State Veterinary College, Cornell University, indicate that veal even a few days old is palatable and has no injurious effects. Veal and lamb may be used as soon as killed and dressed, as they are not improved by hanging.

Veal was formerly considered more indigestible than beef, but experiments have shown that young veal is as easily digested as mature beef. Veal is lacking in flavor and fat, and for this reason fat may be added in the process of cooking. More seasoning should be added than for other meats. It should be thoroughly cooked to soften the large amount of connective tissue and gelatin which it contains.

LAMB AND MUTTON

Lamb is the meat of the immature sheep. Mutton is the meat of the mature animal. The dividing line between lamb and mutton is not based entirely on age. The meat from a well-bred and well-fed animal of one year or a year and a half may still be considered lamb, while the meat from a poorly fed animal of one year may be considered mutton. Lamb will be tender without a period of hanging, while mutton, like beef, should be hung to ripen.

For invalids, lamb chops, either loin or rib, are used more often than the other cuts, although a slice of meat from a well-done roast may be served. Chops should always be broiled, not fried.

PORK

Pork is the meat of the pig or hog and is used extensively throughout the world. A large amount of fat is embedded in the tissues of the hog, and pork contains more fat than any other meat. It is therefore more difficult to digest. Fresh pork should have firm, pinkish white flesh, with firm, clear, white fat. Smoked pork, in the form of ham and bacon, is usually the only form of pork allowed for invalids.

VARIETY MEATS

The organs and the glands of animals are known as variety meat or sundries. Among these, tongue, especially that of beef, has long been a staple. Next to this, the most commonly used has been the liver. The discovery that this organ was so high in food value, especially in its contribution of iron and certain vitamins, caused a large demand for it. The price of delicate calf's liver doubled and tripled. This caused increased use of beef liver. Lamb and pig liver, which have always been used to some extent, are now more in demand. Next in popularity to liver are veal and lamb kidneys, but beef kidney, which is generally less expensive, is also used.

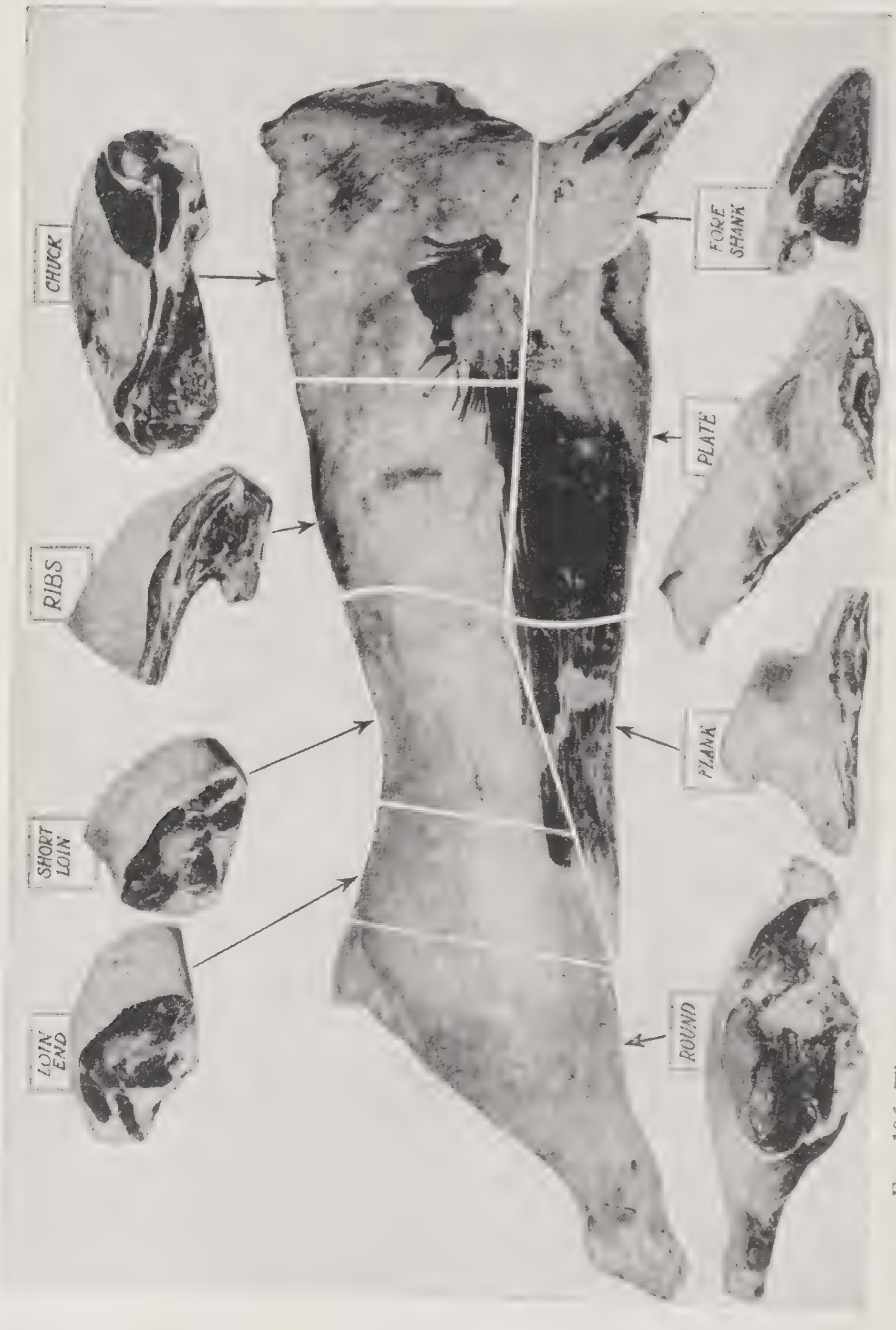


Fig. 106. The various cuts of beef. (Public Relations Department, Swift & Company, Chicago.)

Sweetbreads have always been considered a delicacy, especially for the invalid. Their source is the thymus gland of the calf and the lamb. Lamb sweetbreads are so small that they are seldom seen in market. The pancreas, which is sometimes known as the stomach sweetbread, is occasionally available.

Other portions which belong in this classification of variety meats are heart from the calf or beef, tripe which is obtained from the fatty interlining of the stomach of the beef or calf, and brains which are somewhat like sweetbreads in texture and in flavor.

TYPES OF POULTRY

Chickens, geese, ducks and turkeys are the common domestic birds used as food, although chickens are the most plentiful of the fowls. A capon is a male bird that has been castrated at an early age. Capons are highly prized for their fine flavor and large proportion of light meat. Squab, partridges and other game are luxuries used when obtainable. Because of modern methods of incubation, chickens may be hatched and marketed at any time of the year, so that broilers and fryers are no longer limited to the spring output. In many places it is now possible to buy various parts of chicken, and this is particularly convenient in cooking for the invalid.

The quality of poultry has been standardized to a great extent by modern methods of breeding, care and feeding. Modern methods produce birds with a higher proportion of meat, and tenderness is assured through prevention of exercise. Some birds raised on farms are sold to packing houses, where they are given a final feeding to make them ready for market. Poultry is shipped in both live and dressed form. New methods of killing, picking and cooling protect the dressed birds from contamination. They come to market in both fresh-killed and frozen form. With the new methods of fast freezing, frozen poultry may be of as high quality as that of the best fresh-killed bird. It should, however, be kept frozen until sale. As poultry is as perishable as meat in general, it should be given the same care after it reaches the home kitchen. (See page 460.)

Chickens, the most largely used type of poultry, in various sizes are known by various terms which indicate size and, to some extent, tenderness.

Squab........	¾–1¼ lbs.
Broiler.......	1¼–2½ lbs.
Fryer........	2½–3½ lbs.
Roaster.......	3 lbs. or over
Fowl.........	4 lbs. or over

The quality of poultry depends upon the texture and the flavor of the flesh, as well as upon the distribution of flesh and fat on the carcass. Exercise affects the flavor and the texture of the meat, for with exercise the fibers and the connective tissue are toughened and the extractives are increased. A chicken that has been allowed to run will develop tough leg muscles and have a lessened amount of tender or white meat. The age of a chicken determines its flavor to a large extent—at first, advantageously, and afterwards disadvantageously.

Tests for Poultry

Breast. The breast bone should be flexible. A good table bird should have a large proportion of flesh in relation to the size of bone. The breast should be large and full.

Head. The comb should be red, the eyes clear and full, and there should be no sores on the head. If there are any indications of sores, the bird should be discarded. It is better to purchase birds with the heads on.

Legs. Long thin legs are undesirable, as there is too little meat for the amount of bone.

Skin. The skin should be dry and firm, showing that the chicken has been dry-picked. Chickens that have been scalded will show patches. The color of the skin bears no relation to its quality. Birds with light feathers are easier to make attractive for market than those with dark, but the color of the feathers is not indicative of the quality. Hairs on the skin of a chicken are a sign of age.

Feet. In freshly killed and in young birds the feet feel moist, soft and limber. As the chicken becomes older, the feet become firmer and harder. The feet should not be scaly. Chickens have soft spurs and roosters have hard spurs. The toes of a chicken should not be blunt, as this is a sign of old age.

Fat. Young chickens are seldom fat. Fat should be fairly evenly distributed throughout the carcass, as this develops the flavor of the chicken when cooked. There should be thin streaks of fat under the skin of the breast, but it is not desirable to have any large masses of fat on the chicken.

Wings. The wing bones should be tender and should spring back into place when pulled out. Chickens which have been in cold storage have a squeezed appearance, owing to the packing.

FOOD VALUE

While meat is valued particularly on account of its flavor, its asset to the diet lies in the fact that it contains very easily digested and well-utilized proteins, a goodly amount of phosphorus and an appreciable amount of iron. This last, however, varies with the amount of fat, as the iron is found only in the lean tissue or protein portion of the meat. The internal organs of animals are exceedingly rich in iron.

As far as vitamin content is concerned, meats in general are good sources of the B complex, especially thiamine and niacin. The internal organs such as liver and kidney are richer in vitamins than the muscle tissue. Recent work indicates that lean pork is much higher in thiamine than are other meats. Liver is an exceedingly good source of vitamin A and it also contributes some vitamin C.

Meat rationing during World War II and the scarcity afterwards pointed up the contribution of meat in the daily diet. While it was possible to supply protein enough to supplement the meat available with other protein-bearing foods, the preference for meat is so great that it is difficult to plan satisfying and adequate meals without its use. Figure 107 shows the percentage of daily recommended allowances of minerals and vitamins as well as protein furnished by a 4-oz. serving of meat. Research still in progress indicates that there may be reasons for the use of meat or other good-quality protein-bearing foods not fully recognized at present.

DIGESTIBILITY

The high coefficient of digestibility, from 97 to 98 per cent, is an asset which meat shares with milk and eggs. It is not only completely but rapidly digested. The extractives developed during the ripening process, upon which meat depends for its flavor, may play some part in introducing this high co-efficient degree. Ripening also makes the fibers more tender. Scientific opinion, which some years ago was generally in favor of a limited supply of meat in the diet, has changed in the face of newer research work in regard to digestion and absorption.

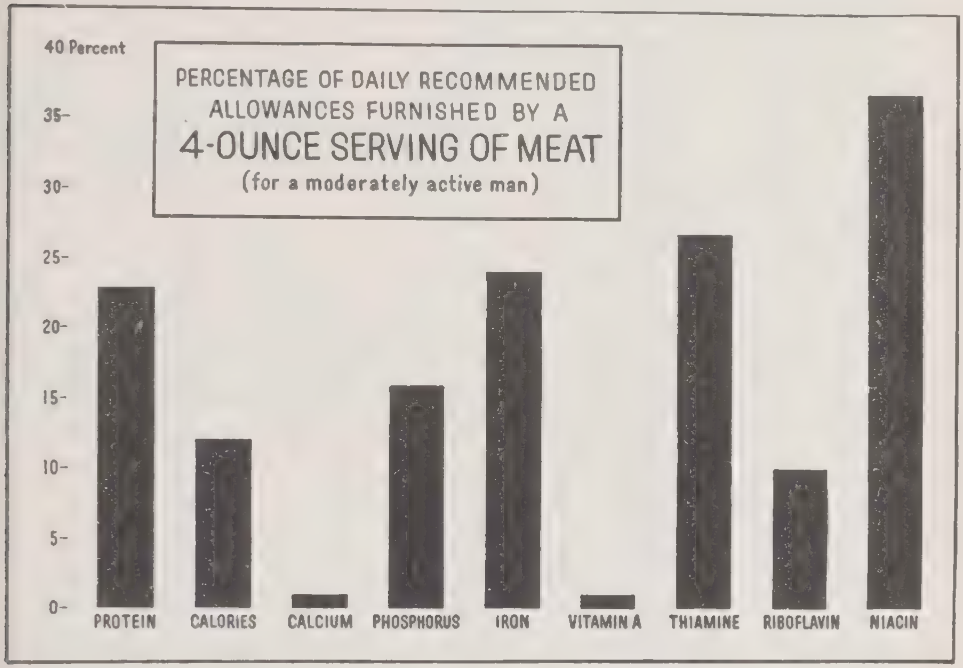


Fig. 107.

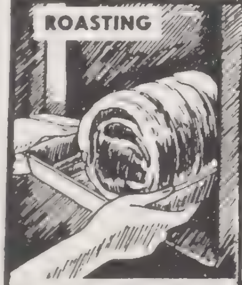
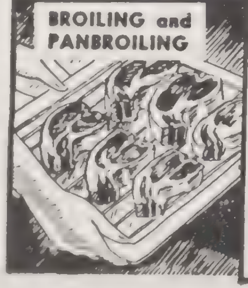
Little importance is attached to the fact that meats contain an excess of acid-forming over base-forming elements, or to the fact that meat protein is more susceptible to intestinal putrefaction than are other proteins. These characteristics may be of importance in certain abnormal conditions but need not be considered in the normal diet. The present cost and scarcity of meat make it unlikely that the quantity in the diet will be large enough to interfere with the consumption of other important foods.

Because so much of the poultry is bone, it is an expensive source of protein; but because of its flavor, which is so well liked by practically everyone, it holds a place of honor among the delicacies of the table. Since it pleases the palate and because it is easily digested, chicken is used in the diet of the invalid more often than other meats. It is sometimes a very valuable asset in tempting the appetite. White meat is slightly more easily digested than dark, because the fibers are held together less firmly and because there is less fat in white meat. There is no support for the opinion that dark meat produces more uric acid than white.

MEAT AND POULTRY IN THE MENU

Under the general term meat, poultry is included with beef, veal,

HOUSEWIFE'S MEAT COOKERY GUIDE

COOKING METHODS	BEEF CUTS	VEAL CUTS	PORK CUTS	LAMB CUTS	VARIETY MEATS
ROASTING 	Standing Rib Rolled Rib Sirloin Chuck Ribs *(high quality)* Rump *(high quality)* Round *(high quality)* Loaf	Rolled Shoulder Cushion Shoulder Arm Roast Blade Roast Rib Loin Rump Leg	Loin Rolled Shoulder Cushion Shoulder Fresh Ham *(pork leg)* Smoked Picnic Smoked Shoulder Butt Smoked Ham Sausages Sliced Salt Pork	Cushion Shoulder Rolled Shoulder Breast with Pocket Rolled Breast Rack	Liver *(beef-veal pork-lamb)*
BROILING and PANBROILING 	Rib Steaks Club Steaks T-Bone Steaks Porterhouse Steaks Sirloin Steaks Chuck Steaks *(high quality)* Rump Steaks *(high quality)* Patties	*Veal is not broiled or pan-broiled*	*Fresh pork is not broiled or pan-broiled* Smoked Ham Slices Sliced Bacon Sliced Canadian Style Bacon Smoked Shoulder Butt Slices Sliced Salt Pork	Rib Chops Loin Chops Shoulder *(arm and blade)* Leg Steaks Patties Choplets *(from breast stuffed with ground lamb)*	Liver *(veal-lamb)* Kidney *(lamb)* Sweetbreads *(beef-veal-lamb)*

FRYING	Thin Steaks (*tender or pounded*) Patties	Chops Cutlets Steaks Patties	Chops Sausage	Thin Chops	Liver (*all kinds if cut thin*) Tripe (*after pre-cooking in water*) Sweetbreads Brains
BRAISING	Chuck (*arm and blade*) Rump Round Heel of Round Brisket Plate Short Ribs Flank Shanks Ox-joints	Breast Rib Chops Loin Chops Shoulder Steaks Cutlets Patties	Rib Chops Loin Chops Shoulder Chops or Steaks Fresh Ham Slices	Breast Neck Slices Shanks Riblets	Liver (*beef-pork*) Kidney (*beef-veal-pork*) Heart (*beef-veal-pork-lamb*) Tripe (*beef*) Sweetbreads (*beef-veal-lamb*)
SIMMERING COOKING IN WATER	Neck Shank Plate Brisket Flank Heel of Round Ox-joints Corned Beef	Neck Shoulder Shanks Flank	Hocks Shanks Feet Backbones Neck Bones Spareribs Smoked Picnic Smoked Shoulder Butt Smoked Ham Shanks Smoked Spareribs Smoked Hocks	Neck Steaks Shoulder Breast	Kidney (*beef-veal-pork-lamb*) Heart (*beef-veal-pork-lamb*) Tongue (*beef-veal-pork-lamb*) Tripe (*beef*) Sweetbreads (*for pre-cooking*) Brains (*for pre-cooking*)

FIG. 108. (National Livestock and Meat Board.)

lamb and pork. Some form of meat will be served the patient at least once a day during convalescence, unless there is some specific reason for its exclusion from the diet. This is rarely the case under modern conceptions of nutrition. If the patient is fond of meat and it is necessary to tempt the appetite, it may be used at both the noon and the evening meal.

Fresh pork is excluded from the diet of the critically ill patient, because of the fat content, which may render it difficult to digest. It may be used occasionally in cases where there are no special diet restrictions if the patient desires it. (Because pork may transmit trichinae, causing trichinosis, it must always be well cooked.) Smoked pork such as ham or bacon may be used interchangeably with other meats unless there is some reason for excluding salt or fat. Among poultry, duck may be forbidden on account of its fat.

Meat for the patient's meals should be planned with reference to the family table. A slice of meat from the roast or a portion of poultry will be a pleasant variation from the chop and the steaks which necessarily must be chosen when the nurse cooks meat especially for the invalid's tray. In addition to the specific directions for broiling steaks and chops, and for the preparation of the glandular meats such as liver, kidney and sweetbreads, which because of their contribution of iron and vitamins are often included in the diet of the convalescent, general directions for roasting are given,

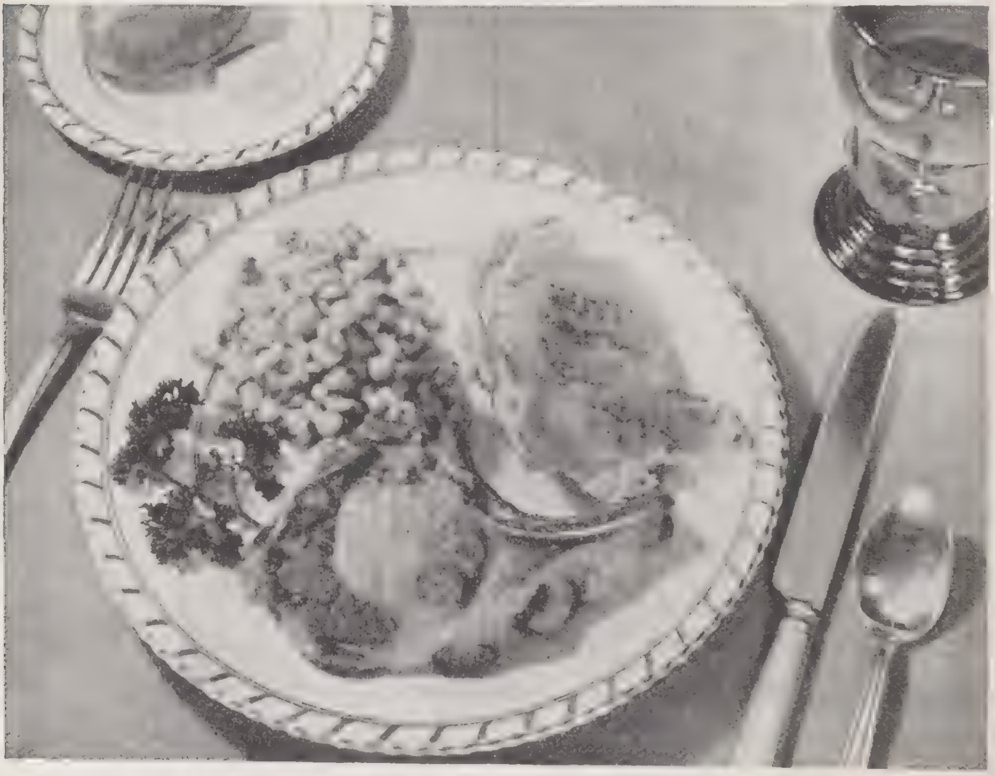


Fig. 109. Braised pork chop with apple sauce and corn stuffing.

as it may be necessary for the nurse to supervise such processes.

GENERAL PRINCIPLES OF COOKERY

Meat. In cooking meat, two principles should be observed in the interest of flavor and texture. Tender cuts, if the flavor is to be preserved, should be cooked without water, which its texture does not demand. Broiling and roasting are the accepted methods for these cuts. A constant low temperature of approximately 300-325° F. is now generally recommended for roasting in order to prevent shrinkage and to produce consistent results. This is particularly important in cooking large quantities. When a high temperature is used at first, it should be lowered to 350° F. after the meat is browned. Uncovered pans should be used for roasting. For less tender cuts, the use of some liquid is necessary. Pot roasts are often seared by browning in hot fat before the liquid is added and cooking is continued in a covered utensil. For soups, where the aim is to draw the flavor into the liquid, part of the meat may be seared for flavor and the remainder put directly into cold water and simmered for a long time, the pot being covered for the first portion of the cooking.

Pork. Fresh pork should be cooked until every vestige of pink coloring in the flesh has disappeared. Particular care should be taken to follow directions for cooking which come with the tenderized smoked hams now so generally distributed. The meat itself becomes tender enough to eat before the cooking process has been sufficient to kill trichina spiralis which may be present. Unlike any other food animal, a pig or hog is susceptible to trichinosis, which may be passed on to humans if measures to kill any parasites present are omitted. Under the present methods of production and slaughtering, the only insurance is thorough cooking in the home kitchen.

EFFECT OF COOKING ON FOOD VALUE

As practically all meat is eaten in cooked form, research has been concerned with the loss of natural vitamin content in cooking. Study of the chart "Range of Vitamin Values for Raw and Cooked Meats" shows the differences which heat treatment

RANGE OF VITAMIN VALUES FOR RAW AND COOKED MEATS *

(Common cuts and various methods of cooking. See Table 1, Part Four, for vitamin values of specific cooked cuts.)

Edible Portion Medium Fat	Thiamine mcg.	Riboflavin mcg.	Niacin mcg.
Beef			
raw	100– 120	120–160	4.2–5.2
cooked	35– 85	90–150	3.0–5.0
Lamb			
raw	180– 210	230–260	5.2–5.9
cooked	125– 150	200–260	3.6–5.4
Pork, fresh			
raw	920–1,040	180–210	3.9–4.5
cooked	660– 810	160–190	3.1–4.2
Pork, cured (ham)			
raw	650	210	4.1
cooked	540	175	3.4
Veal			
raw	170– 180	260–280	6.0–6.4
cooked	75– 140	230–260	5.5–6.1

* Food and Nutrition Board, Table of Vitamin Losses in Cooking, 1944.

U. S. Department of Agriculture Table of Food Composition, Misc. Pub. No. 572.

National Live Stock and Meat Board, Food and Nutrition News, January, 1946.

makes in the vitamin value of the various kinds of meat.

Experiments have also shown that various vitamins in various cuts of meat are affected differently by the same methods of cooking. Frying, for instance, does not reduce the thiamine content, but it has some effect upon riboflavin and more on niacin. On the other hand, braising and stewing reduce thiamine to a greater extent than they do riboflavin and niacin. Results from roasting and broiling are about the same with regard to all three of the vitamins. (See Fig. 110.)

Soups prepared from meat and bones have very little food value. The extractives, which are soluble, are drawn out by cooking in water and contribute flavor to the stock in ratio to its concentration. The small amount of protein is in the form of gelatin. Soups made with meat stock are appetizing rather than nourishing.

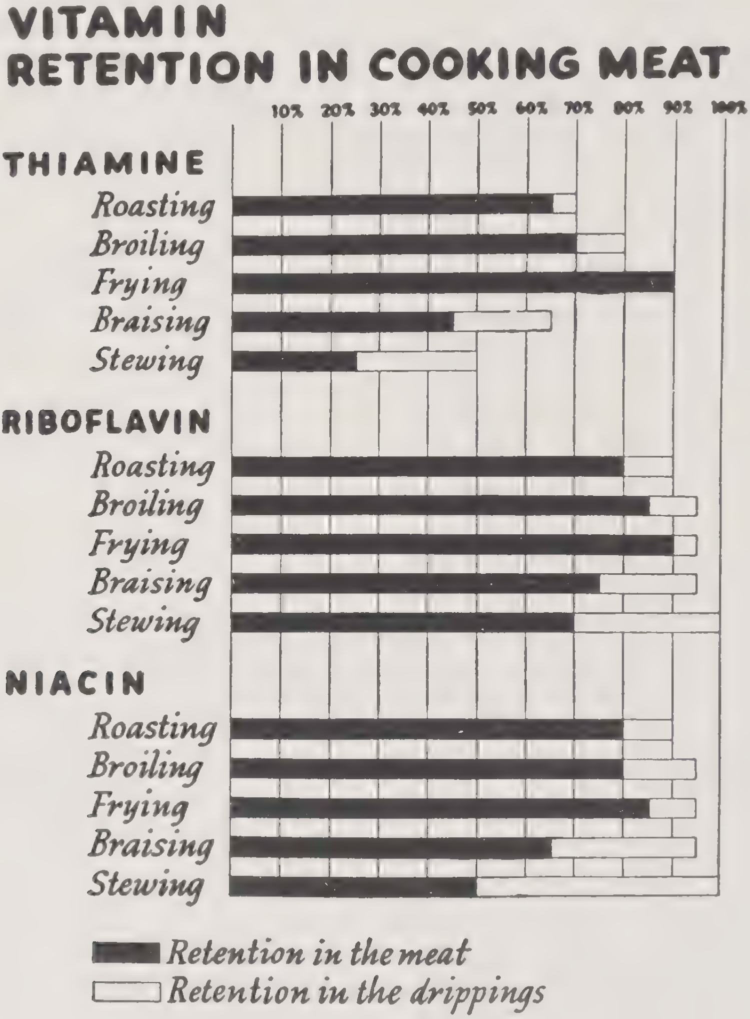


Fig. 110.

CARE AND PREPARATION OF MEAT

All fresh and cooked meat must be stored in the refrigerator. Fresh meat and poultry should be lightly but not tightly covered with waxed paper. Chopped meat and glandular meats should be used the day they are purchased or stored in the freezing compartment of the refrigerator. Leftover cooked meat, if used for the patient, should not be stored longer than 24 hours as a precaution against the slightest taint or change in flavor and in quality.

If quick-frozen meats are purchased, they should be defrosted before cooking. This will take from three to four hours at room temperature. If they are not to be used on the day of purchase, they should be stored in the freezing compartment of the refrigerator. No attempts should be made to refreeze after thawing. If only a portion of a carton is required, that portion should be cut off and allowed to thaw and the remainder should be placed at once in the freezing compartment.

Broiling and roasting are the two methods generally used in the preparation of meat for the patient. For the former, the preheated broiling oven or preheated small, heavy frying pan may be used. As roasting is suitable only for a large portion of meat, this method will seldom be used by the nurse in preparing meals for her patient. Roasting methods are, however, included among the recipes, as the nurse may be called upon to advise with regard to the proper preparation, and she may also find them useful in her own cooking problems.

MEAT RECIPES

Broiled Steak

Procedure: If only 1 portion of steak is to be prepared, a cut from the tenderloin is generally used. Allow from ¼ to ½ lb. for each serving. Small club steaks are delicious when broiled, but they will weigh at least 1 lb. Steaks are usually cut at least 1½ inches thick, although very thin steak known as "minute" steak may be cooked by a special method. Allow ¼ lb. for a serving.

Preheat broiling oven from 5 to 10 minutes and grease rack. Wipe meat with cloth and broil from 2 to 3 inches below heat. Sear meat on both sides, reduce heat and continue cooking, turning occasionally. For rare steak 1½ inches thick allow from 12 to 15 minutes. Sprinkle both sides with salt and pepper, spread with softened butter if desired.

Pan-broiled Steak

Procedure: Wipe meat with cloth; heat heavy frying pan and grease lightly with fat from meat. Place steak in pan, cook 1 minute over high heat, turn and cook 1 minute, lower heat and continue cooking from 8 to 10 minutes, turning often. Pour off fat as it accumulates in pan. Sprinkle both sides with salt and pepper, spread with softened butter if desired.

Minute Steak

Procedure: Heat heavy frying pan until very hot and grease liberally. Sear steak quickly on both sides, lower heat and cook 2 minutes on each side. Sprinkle with salt and pepper, spread with softened butter if desired.

Broiled Hamburg

Ingredients:

¼ lb. ground beef
⅛ teaspoon salt
Dash pepper
½ teaspoon cream or evaporated milk

Procedure: Mix beef with seasonings and moisten with cream or evaporated milk.

Form into a thick cake. Make an indentation in the center and broil under moderate heat about 7 minutes on each side. Serve on warm plate and place 1 teaspoon catsup or chili sauce in indentation. The meat may be formed into 2 thin cakes and broiled about 3 minutes on each side. Yield: 1 serving.

Broiled Lamb Chops

Procedure: Select loin or rib chops, single or double as desired. Follow directions for broiled steak or pan-broiled steak (p. 491). For single chops allow from 12 to 15 minutes. For double chops from about 15 to 20 minutes.

Pan-broiled Pork Chops

Procedure: Have chops cut about 1 inch thick. Wipe with cloth, sprinkle with salt and pepper and dredge with flour. Heat heavy frying pan and brown chops lightly on both sides in their own fat, turning frequently. Pour off excess fat as chops cook. Cover and cook over very low heat from 25 to 30 minutes (until tender).

Broiled Ham

Procedure: Preheat broiling oven 5 minutes. Trim skin and wipe meat with cloth, cut fat round edge in several places. Broil 3 inches below moderate heat, turning occasionally. Allow 10 minutes for slice ¼ inch thick and 20 minutes for one ½ inch thick. After ham is broiled it may be sprinkled with brown sugar and returned to broiler just long enough to melt the sugar. Allow ¼ lb. for each serving.

Pan-broiled Ham

Procedure: Trim skin and wipe meat with cloth, cut fat round edge in several places. Heat heavy frying pan and grease with fat from ham. Cook over moderate heat, turning often until well browned. Allow ¼ lb. for 1 serving.

Veal Steak

Procedure: Select veal steak cut ½ inch thick. Dredge with flour, salt and pepper, and sauté in a small amount of butter or bacon fat, turning constantly until brown. Add ½ cup water, cover and simmer from 20 to 30 minutes (until tender). Allow ½ lb. for 1 serving.

ROASTING

Tender cuts of meat such as ribs of beef, rack or leg of lamb, veal and pork are usually chosen for roasting. Shoulder of lamb, pork and veal are also roasted. An allowance of ½ lb. of meat per serving is generally made.

GENERAL DIRECTIONS FOR ROASTING

Wipe meat with cloth, rub with salt and pepper and place fat side up in uncovered roaster. If meat thermometer is used, make a hole with skewer through fat side and insert thermometer in center of roast but do not let it touch the bone. Preheat oven to 325° F. Roast at this moderately slow temperature. For any rolled boned roast increase time allowance 10 minutes per lb. according to directions for each type of roast.

Roast Beef

Procedure: For rare roast beef allow from 21 to 25 minutes per lb., or until meat thermometer reads 140° F. For medium roast beef allow from 27 to 35 minutes per lb., or until thermometer reads 160° F. For well-done roast beef allow from 33 to 40 minutes per lb., or until thermometer reads 170° F.

Roast Lamb

Procedure: For medium roast lamb allow from 32 to 35 minutes per lb., or until meat thermometer reads 180° F. For well-done roast lamb allow from 40 to 45 minutes per lb., or until thermometer reads 185° F.

Roast Fresh Pork

Procedure: Allow 45 minutes per lb., or until meat thermometer reads 185° F.

Roast Veal

Procedure: Allow 30 minutes per lb., or until thermometer reads 170° F.

Baked Ham

Most hams on the market today have been tenderized during curing. They may be baked without previous soaking or boiling, except in the case of "country ham." If directions are given on the wrapper, they should be followed exactly. The full time allowance must be given, as underdone ham may transmit trichinae. An allowance of 25 minutes per pound is generally made, or until the meat thermometer reads 170° F. Take ham from oven, remove skin, spread with paste made from a mixture of brown sugar and prepared mustard and return to oven for 30 minutes. Baste occasionally with the sirup which accumulates in the bottom of the pan.

Brown Gravy for Roasts

Ingredients:

¼ cup drippings from roast
5 tablespoons flour
2 cups cold water or stock
Salt
Pepper

Procedure: Remove roast to hot platter. Pour off drippings if they exceed more than ¼ cup. Add flour and stir until thoroughly mixed with drippings. Continue stirring until flour is browned. Add water or stock slowly, stirring constantly. Stir over low heat until gravy thickens and boils. Add salt and pepper to taste. Yield: 2 cups gravy.

Note: If a small amount is to be made, place required amount of drippings in a small frying pan, reduce flour and water accordingly and follow directions.

MISCELLANEOUS

Bacon

Bacon may be pan-fried, broiled or baked. When 1 portion is prepared for the invalid's tray the pan-frying method will be used generally. Usually from 2 to 3 strips of bacon are allowed for each serving.

Baked Bacon

Procedure: Arrange strips of bacon in baking pan. Bake in moderately hot oven (400° F.) until golden brown. Drain on soft paper.

Pan-fried Bacon

Procedure: Place bacon without separating into strips in cold frying pan. Cook over low heat 2 or 3 minutes. Separate strips and turn occasionally until golden brown. Drain on soft paper.

Broiled Kidneys

Procedure: Choose 1 veal kidney or 2 lamb kidneys for each serving. Split kidney, remove membrane and tubes, and soak in salted water 20 minutes. Drain and dry; dip in melted butter. Preheat broiling oven 5 minutes. Arrange alternate pieces of kidney and 1-inch squares of bacon on metal skewers, and broil 3 inches from the heat about 15 minutes, turning occasionally.

Pan-broiled Liver

Calf's liver is generally used for the invalid's tray because it is both tender and delicate in flavor. Liver from beef, lamb or pig, which is less expensive, is also very good when properly cooked.

Procedure: Have liver sliced ½ inch thick. Wipe with cloth and remove skin and tubes if this has not already been done at the store. Dredge with seasoned flour. Cook in hot, well-greased frying pan about 5 minutes, turning occasionally until well browned. Add more fat as needed. Bacon fat or butter is used generally for cooking liver. Care should be taken not to overcook liver, for long cooking will make it tough. Allow ¼ lb. for 1 serving.

Broiled Sweetbreads

Procedure: Wash sweetbreads, cover with boiling water, add 1 teaspoon vinegar and ¼ teaspoon salt. Bring to boiling point, cover and simmer over low heat 15 minutes. Drain, plunge in cold water, drain again and remove membrane and tubes. Drain and dry. Preheat broiling oven and grease rack. Brush sweetbreads with melted butter or salad oil and sprinkle with salt and pepper. Broil 3 inches below the heat about 10 minutes, turning occasionally. Serve with melted butter flavored with lemon juice. Allow 1 sweetbread for 1 serving.

Creamed Sweetbreads

Ingredients:

½ boiled sweetbread
1 tablespoon butter
1 tablespoon flour
½ teaspoon salt
Pepper
½ cup milk
¼ cup cream
1 teaspoon lemon juice
1 tablespoon minced parsley

Procedure: Prepare and boil sweetbread according to directions in preceding recipe; cut sweetbread into small pieces. Melt butter, stir in flour, salt and pepper; when blended stir in milk and cream gradually and continue stirring over low heat until sauce thickens and boils. Add lemon juice and parsley. Add sweetbread, reheat and serve on hot toast or in a croustade. Yield: 1 serving.

Creamed Drief Beef

Ingredients:

1 tablespoon butter
¼ cup shredded dried beef
2 teaspoons flour
¾ cup milk

Procedure: Melt butter in a small frying pan, add beef and cook until light brown. Sprinkle with flour and blend. Add milk gradually, stirring constantly over low heat until mixture thickens and boils. Serve on toast or on hot biscuits as desired. Yield: 1 serving.

Baked Hamburg

Ingredients:

¼ lb. ground beef
Dash salt
Dash pepper
Dash mustard
1 small onion, sliced
Melted butter

Procedure: Mix beef with salt, pepper and mustard. Form into flat cake, place in greased baking pan, top meat with overlapping onion slices and brush with butter. Bake about 10 minutes in moderately hot oven (400° F.). Yield: 1 serving.

Scraped Beef

Procedure: Take a piece of round steak, scrape with a knife to free it from the connective tissue, season with salt and serve as desired. It may be spread between slices of bread and served as a toasted sandwich, or it may be formed into a ball and pan-broiled slightly.

Meat Stews

For meat stews and other family-size meat recipes see Chapter 51.

CHOICE AND PREPARATION OF POULTRY

The term poultry is used to describe domestic birds such as chicken, squab, turkey, guinea hen, goose and duck; and game such as quail, partridge and pheasant. Chicken is used more than any other form of poultry in the invalid's diet. Squab may be selected because one squab provides only one portion. Baby chickens, which are known as squab chickens, and partridge also have this advantage. A small broiler may be chosen, especially for the patient. One half may be cooked and the rest reserved for use a day or two later. The nurse may be called upon to roast squab, baby chicken or partridge, or to prepare a broiler.

As it is now possible in many markets to buy any portion of chicken desired, this is helpful when meat is being reintroduced into the diet and white meat of chicken has been specified by the physician. It is also convenient when the convalescent patient has a special desire for some particular chicken dish.

As it may be necessary for the nurse to supervise the preparation of boiled chicken, the method of preparation is included in this chapter. When chicken or other fowl is to be served at the family table, some of the breast meat should be reserved for the patient, when allowed, unless other portions are preferred. If a chicken fricassee is served the family, some of the white meat may be reserved for use in preparing creamed chicken or chicken salad for the patient.

Poultry is generally purchased dressed and drawn. It may be ordered split for broiling or cut in pieces for frying or other purposes. If singeing is necessary, hold the bird over direct heat and turn until all the hair has disappeared. Then wash inside and out under running water. Remove pieces of red spongy lungs, remove oil sac above tail with a sharp knife and pin feathers with tweezers.

Proper cooking, which develops and holds the delicate flavor of the meat, is important in preparing chicken for the invalid's tray. Young chicken may be broiled or oven-cooked in a small amount of fat. Older birds may be roasted or fricasseed. A brown fricassee is often more appealing to the appetite than the white stew, which is too often made from chicken after the broth has been extracted for soup. Chicken broth is usually favored by an invalid because of its flavor. A very palatable broth may be made from the bones of roast chicken if but a small amount of water is used. Squab, when available, may be used to good advantage if the budget will permit, as one squab provides one serving.

POULTRY RECIPES

Boiled Chicken

Procedure: Choose a 5-lb. fowl and have it disjointed at market. Wash and place in kettle with 1 quart boiling water. Add ¼ cup celery leaves or 1 stalk celery, 1 sliced onion, 1 bay leaf, 4 peppercorns and 1 tablespoon salt. Bring to boiling point, cover, and let simmer over low heat about 2 hours or until tender. The time will depend upon the age of the fowl. Let meat cool in the liquid before removing for use in salads or in creamed dishes. Use stock in sauces or soups, or as broth. Allow about ¾ lb. for 1 serving. A 5-lb. fowl gives about 3 cups diced cooked chicken.

Fricassee of Chicken

Ingredients:

1 boiled chicken
4 tablespoons butter
6 tablespoons flour
2 cups chicken stock
1 cup top milk
Salt
Pepper
2 tablespoons chopped parsley

Procedure: Follow directions for boiled chicken (see preceding recipe). Drain and reserve stock. Melt butter, add flour, stir until well blended, and add chicken stock and milk gradually. Stir constantly over low heat until sauce thickens and boils. Add more salt and pepper if necessary. Reheat chicken in sauce. Arrange on hot platter and sprinkle with parsley. Surround with hot biscuits (p. 553) or boiled rice (p. 441). Yield: 6 servings.

Creamed Chicken

Ingredients:

1 tablespoon chicken fat or butter
2 teaspoons flour
¼ teaspoon salt
Pepper
¼ cup chicken stock
½ cup milk
½ cup diced cooked chicken
1 teaspoon minced parsley

Procedure: Melt butter, stir in flour and seasonings, and when well blended add chicken stock and milk slowly, stirring constantly over low heat until the mixture thickens and boils. Add chicken and parsley. Reheat and serve on hot toast or split baking powder biscuits (p. 553) or in tart shells. Garnish with strips of pimiento if desired. Yield: 1 serving.

Note: Chicken stock may be replaced by ¼ cup cream.

Casserole of Creamed Chicken

Procedure: Follow directions for creamed chicken (p. 495). Place in small, buttered baking dish, sprinkle with buttered bread crumbs or with grated cheese and bake about 10 minutes in a moderately hot oven (400° F.) until lightly brown.

Creamed Chicken with Mushrooms

Procedure: Follow directions for creamed chicken (p. 495), substituting ¼ cup sliced cooked or canned mushrooms for an equal amount of chicken.

Broiled Chicken

Procedure: Select broilers weighing from 2 to 2½ lbs. Have broiler split in half and joints broken at market. Wash thoroughly and dry. Preheat broiler about 10 minutes. Place half of broiler in the refrigerator for later use. Brush other half with butter or salad oil, sprinkle with salt and pepper. Place skin side down on broiler rack 3 inches below heat. Cook from 30 to 40 minutes, turning several times and basting frequently with melted fat. Serve on hot plate with extra melted butter if desired.

A broiler may be baked in the oven from 30 to 50 minutes until tender. A high temperature (500° F.) should be used for the first 15 minutes, then reduced to moderate (375° F.). It should be basted occasionally with fat which accumulates at bottom of the pan. One serving: ¾ to 1 lb.

Fried Chicken

Procedure: Have chicken cut into pieces for serving. Wipe with damp cloth and sprinkle with salt and pepper. Dredge liberally with flour and rub flour into flesh. Dredge again, continue rubbing until no more flour can be absorbed. Fry in hot fat, which should be at least ½ inch in depth in frying pan. Lard or vegetable shortening is used generally. Turn chicken constantly until golden brown. When tested with fork, the juice should be colorless. If chicken is not tender by the time it is brown, cover and remove from heat and let stand ½ hour to finish cooking by retained heat. Serve with cream gravy if desired. To make cream gravy follow directions for cream sauce (p. 521), substituting some of the fat in which the chicken has been cooked for the butter. Allow ¾ lb for 1 serving

Roast Squab

Procedure: Clean squab, rub lightly inside and out with butter, and sprinkle with salt and pepper. Place breast side up in uncovered pan and roast in a very hot oven (500° F.) for 5 minutes until brown. Turn breast side down, reduce heat to slow (325° F.) and continue roasting about 20 minutes (until meat is tender). Serve with currant jelly.

Squab may be stuffed with well-seasoned buttered bread crumbs. Salt, pepper, minced onion and celery may be used to season the stuffing. Allow 1 cup soft bread crumbs for stuffing.

Roast Baby Chicken

Procedure: Follow preceding directions for roast squab.

Roast Partridge

Procedure: Follow directions for roast squab (above).

Chicken Livers

Procedure: Chicken livers may be sautéed 2 or 3 minutes in butter or may be halved, dipped in melted butter or salad oil and placed on skewer for broiling under a moderate heat for about 2 minutes on each side.

BROTHS, SOUPS AND JUICES

Meat soups, broths and juices are valued more because of the way in which they stimulate appetite than because of the very small amount of food value they contribute. They can often be taken by a patient when there are digestive disturbances which make it difficult to tolerate other liquids. Canned consommé may often be used, but there may be occasions when it is necessary for the nurse to prepare soup stock or meat juice.

To Serve Soup. Bouillon cups or cream soup dishes rather than soup plates should be used on the invalid's tray. They should be heated before soup is served. Covered soup bowls should be used when available, otherwise a saucer may be placed over the cup or cream soup dish in which the soup is served. The dish should be placed on a plate, and if any soup is spilled on the way from the kitchen to the bedroom the plate should be wiped or removed before the soup is offered the patient.

Hot crackers or Melba toast should be served separately on a small plate. Croutons may be placed in the soup just before it is to be served.

Clear Soups

Meat stock is the foundation for soups variously known as consommé, bouillon and broth. There is no clear distinction among them. The first two are generally made from fresh meat and bone purchased for the purpose of making soup stock. The less tender cuts of meats with the bones are chosen both because they have more flavor and are less expensive than more tender meat. Beef is selected for brown stock, and all or part is generally seared until well browned before water and seasonings are added. For white stock, unbrowned chicken and veal are used. If a pressure cooker is available, soup stock (broth) can be made quickly. The directions which come with the cooker should be followed exactly.

The bones from leftover cooked meat will also make an acceptable stock, though sometimes with a little less flavor. The carcass of a chicken or a turkey is often used for broth. If strong soup is desired, water should be added sparingly. If a pressure cooker is available, more flavor can be extracted from the meat or bones, whether previously cooked or uncooked. The gelatin content of the bones is also more easily extracted. A soup which will jelly in the refrigerator after having been strained is generally a soup of strong flavor. The addition of vegetables and herbs to the stock pot improves flavor. A clear jellied soup stock may be served cold or may be heated until the jelly melts and the soup is thoroughly hot.

A clear soup should be strained carefully after the cooking of the stock has been completed, and if it is to be completely clarified a special procedure is necessary. The consensus of opinion is that a strong homemade soup will be appetizing enough in appearance to allow the omission of final clarifying.

The skimming of soup stock should be done carefully after the strained stock has been chilled in the refrigerator. The fat will rise to the top and form a hard layer which can be removed easily. A soup upon which fat globules float may create a prejudice against soups as a class.

Clear Soup Base. A clear soup base is used as a foundation for a vegetable soup. Rice or barley is sometimes added with the vegetables and will, of course, provide additional food value. Noodles may be cooked in the clear stock and are generally served without the addition of vegetables.

Brown Soup Stock (Broth)

Ingredients:

- 2 lbs. lean beef, with bone
- 6 cups cold water
- ½ teaspoon salt
- 3 peppercorns
- 3 cloves
- 2 tablespoons each chopped onion, carrot, celery
- 1 sprig parsley

Procedure: Cut meat in 1-inch pieces and brown half in its own fat or in extra fat until seared on all sides. Crack bones and add to cooked meat. Add remaining meat and other ingredients. Bring slowly to boiling point, cover and let simmer 3 hours. Strain, cool quickly and remove layer of fat which forms on the top as stock cools. Yield: Approximately 1 quart.

Note: If pressure cooker is used, reduce water to 4 cups.

White Soup Stock (Broth)

Procedure: Make according to preceding directions for brown soup stock, substituting 1 knuckle of veal for beef. Make stock without browning any portion of the meat.

Consommé (Bouillon)

Procedure: Mix 1 unbeaten egg white and 1 crushed eggshell with 2 tablespoons cold water and add to 1 quart strained skimmed brown or white soup stock (broth). Stir over low heat until stock boils. Remove from heat, add ¼ cup cold water and cool. Then strain through two thicknesses of cold wet cheesecloth.

Jellied Consommé (Bouillon)

Ingredients:

- 1 tablespoon unflavored gelatin
- 2 tablespoons cold water
- ¾ cup well-seasoned soup stock or canned consommé
- 1 tablespoon lemon juice
- 1 slice or ¼ lemon
- 1 teaspoon minced parsley

Procedure: Soften gelatin in cold water and dissolve in hot stock or consommé. Place in bouillon cup and chill in refrigerator several hours (until set). If desired, break up lightly with fork. Garnish with sliced lemon and minced parsley or with cooked or canned small mushrooms.

Jellied Tomato Bouillon

Procedure: Follow directions for jellied consommé, substituting well-seasoned tomato juice for the soup stock or consommé.

Jellied Madrilene

Procedure: Follow directions for jellied consommé, using equal parts soup stock or consommé and well-seasoned tomato juice.

Note: Jellied Madrilene can be purchased in canned form. The can should be chilled in the refrigerator before it is opened. It should be beaten lightly with a fork before being served in bouillon cup.

Vegetable Soup

Procedure: Diced cooked vegetables, canned or fresh tomatoes, boiled rice or barley, cooked noodles or vermicelli may be added to any type of stock. Allow ¼ cup of any one of these products or in combination to 1 cup stock. If fat is allowed in the diet, diced raw vegetables such as carrots, potatoes, turnips and minced onion may be cooked 2 minutes in a small amount of butter before the addition of stock. The saucepan should be covered and the soup cooked until the vegetables are tender. Canned consommé, bouillon cubes or instant broth dissolved in water may replace stock.

Chicken Broth

Procedure: If chicken broth is to be made in the household, plans for the use of

Fig. 111. Jellied consommé is refreshing on a warm day.

boiled chicken (p. 495) should be made. If chicken fricassee is to be served on the family table, some of the stock from the boiled chicken which forms its base may be reserved for use on the invalid's tray. The stock should be chilled, then skimmed so as to be free of fat before it is reheated for the patient.

Beef Juice

Ingredients:

½ lb. lean beef
Salt

Procedure: Broil beef (about 4 inches square and 1 inch thick) on both sides. Two minutes should be sufficient.

Lay beef on a plate, sprinkle with salt, cut in pieces, place in meat press or potato ricer and squeeze out all the juice. Yield: About 2 ounces or 4 tablespoons juice.

Sufficient juice for two servings is generally prepared at one time. To warm the second portion, place the juice in a cup, set cup in boiling water, stir juice constantly until it is a little more than lukewarm and serve at once.

Beef Tea

Ingredients:

1 lb. chopped lean beef
1 pint cold water
½ teaspoon salt

Procedure: Place finely chopped or ground beef in a fruit jar. Add cold water and allow to stand 1 hour. Place jar in a saucepan of cold water with a cloth on the bottom of pan under the glass and heat the water over low heat. Be careful not to let it boil. Keep below boiling for 2 hours. Then slowly increase heat sufficiently to turn the beef tea a deep chocolate color. Strain and add salt. Never allow beef tea to boil, either in making or in reheating. Yield: 2 servings.

Liver Juice

Procedure: Score raw liver and sear on both sides over high heat. Place seared liver in a square made of gauze and squeeze out juice. There should be about ⅙ cup of juice from 1 pound liver. Season if desired. Yield: 1 serving.

Liver Soup

Ingredients:

3 oz. liver
1 cup broth or tomato juice
Salt

Procedure: Scrape liver. Add to clear broth with fat removed or to tomato juice. Simmer 5 minutes. Season with salt and onion juice or celery salt to taste. Yield: 1 serving.

(For *soups other than those made from meat,* see Chap. 49.)

REVIEW QUESTIONS

1. Discuss the change in trend in meat consumption in the United States.

2. Why must meat be handled carefully in its preparation for market and also in the home kitchen?

3. Give the reasons why meat is considered a valuable part of the diet. State why liver and other organs have a particularly high rating.

4. Discuss the digestibility of meat. Why is the white meat of chicken often served early in convalescence?

5. Outline the principles of meat cooking. Why should particular precautions be used in cooking pork?

6. Compare the vitamin values of raw and cooked meats.

7. What is the value of meat soups, broths and juices?

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Fish and Shellfish

Chapter Topics

FOOD VALUE	SELECTION AND CARE OF FISH
TYPES OF SHELLFISH	FISH RECIPES
OTHER FOODS GROUPED WITH FISH	SELECTION AND CARE OF SHELLFISH
DIGESTIBILITY	SHELLFISH RECIPES
PLACE IN THE MENU	

Fish and meat compare well in the nutritive constituents protein and fat. Fish, however, has fewer extractives, which are responsible for the characteristic flavor of meat. While various types of fish have a certain individuality of flavor, except in the case of shellfish, they do not differ in this respect as much as does the flesh of different animals. Varieties of fish not ordinarily used are now being introduced to the markets and a definite effort is being made to stimulate production and use of both salt-water and fresh-water fish. Modern methods of quick freezing are making it possible for communities far from sources of production to have a regular distribution of good-quality fresh fish. The production of canned, salted and smoked fish, with which the war interfered so seriously and on which there was general dependence, has now been resumed.

FOOD VALUE

Weight for weight, fish is not generally so high in calories as meat, because of the lower fat and the higher water content. Fish is rich in gelatin, which is soluble in hot water. For this reason more of the nutritive value is lost in boiling fish than in baking or broiling.

As will be seen in Table 1, Part Four, there is little difference in the protein content of the various fish. There is a great difference, however, in the fat content, which varies from less than 1 per cent to more than 12 per cent. This factor has led to the classification of fish under two heads: fish low in fat and fish high in fat. The amount of fat in all fish varies somewhat with the season of the year, with the time of spawning and with changes in feeding conditions. It may be noted that certain fish which have very little fat in the edible portion have a comparatively large amount in the liver. Fish liver furnishes oil which is high in both vitamins A and D. Cod and halibut are commonly used, but mackerel, tuna, swordfish and several other species yield liver oils which are more potent.

Salt-water fish are valuable because of their iodine content. The phosphorus and the calcium which they contain are about equal to those of meat, but the iron content is lower.

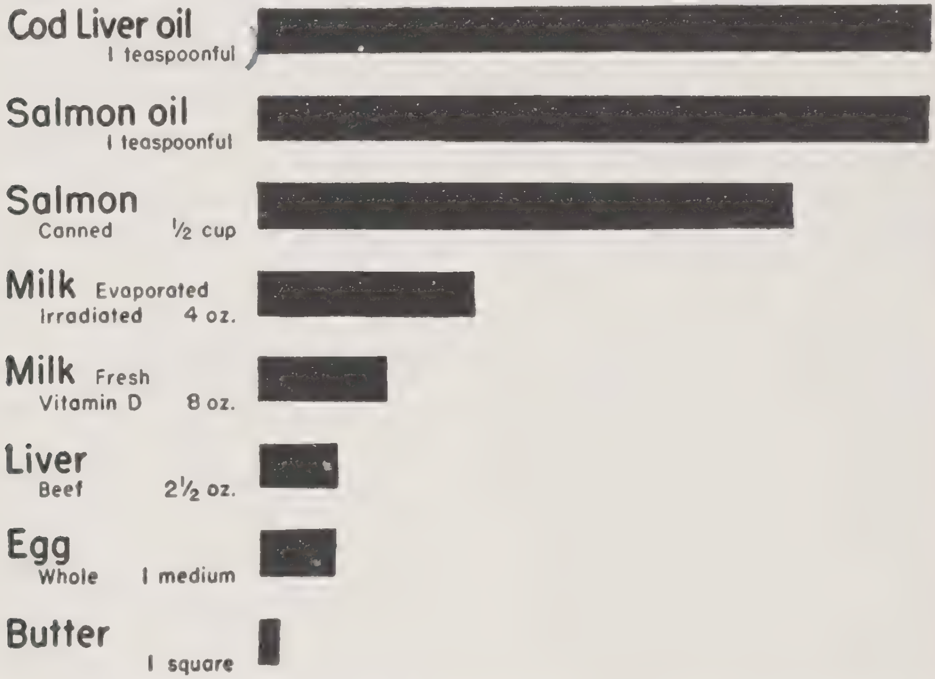

Fig. 112. Sources of vitamin D. Fish is the richest source of vitamin D. (Philadelphia Child Health Society.)

Fish eggs, which are known as roe, are used to some extent as food and are counted a delicacy. Of these, shad roe may be obtained in both fresh and canned form. The roe of the sturgeon, which is known as caviar, is obtainable in salted form. So-called fresh caviar is mildly salted and packed in tin or in glass. It is much more expensive than the caviar which is more highly salted, packed in barrels for export and later canned. Caviar, which was once a common product in the United States before the American sturgeon was practically exterminated, is now imported from Russia. A small amount of inexpensive whitefish caviar is produced in the United States. In contrast with shad roe, which is used as a main dish, caviar is used merely as an appetizer and seldom has a place in the diet of an invalid.

Shellfish may be divided into two classes: mollusks and crustaceans. Mollusks include oysters, clams, mussels and scallops; crustaceans include lobsters, crabs and shrimps.

Like other seafoods, these are all valuable for their protein content, although they vary in the percentage composition, as will be seen by consulting the several tables which follow. Most shellfish are high in minerals; as a class they constitute a very valuable source of iodine.

TYPES OF SHELLFISH

Oysters

Oysters are among the most important of the shellfish, as they are

COMPOSITION OF TYPICAL FISH

Kind	Water per cent	Protein per cent	Fat per cent	Calories per Lb.	Calories per 100 Gm.
LOW IN FAT					
Bass	77	21	2	102	463
Cod	83	17	Tr.	68	309
Flounder	83	15	1	69	322
Haddock	82	17	Tr.	68	309
Pike	80	19	1	85	386
Trout, brook	78	19	2	94	427
HIGH IN FAT					
Bonito	68	24	7	159	722
Herring	73	19	7	139	631
Mackerel	68	19	12	184	835
Salmon, Pacific	63	17	17	221	1,003
Shad	70	19	10	166	754
White Fish	70	23	7	155	704

PROXIMATE COMPOSITION OF SHELLFISH

Description	Water per cent	Protein per cent	Fat per cent	Carbohydrate per cent	Calories per Lb.	Calories per 100 Gm.
Clams, long and round	80	14	2	2	82	372
Crabs	80	16	2	1	86	390
Lobsters	79	16	2	1	86	390
Mussels	77	14	2	5	94	427
Oysters	80	10	2	6	82	372
Scallops	80	15	Tr.	3	72	327
Shrimps	78	18	1	1	85	386

often used in the invalid's diet. They are grown abundantly in shallow salt water along the shores of the United States. Two thirds of the world's supply of oysters are grown in the United States.

The market season for oysters opens the first of September and closes the first of May. They are not a desirable article of food during the summer, which is the spawning season. This season varies in different localities, but covers a period of from four to six weeks. After harvesting, oysters should be kept alive until required for use in a cool, damp place. They should be placed with the large side of the shell down and sprinkled with salt water. Care should be taken that each shell is reached by the water.

Among the best-known varieties are blue points, lynnhavens, rock aways, saddle rocks, shrewsburys, etc. Such names formerly indicated the locality in which the oysters were grown, but this no longer holds, the name generally denoting merely the size of the oyster. For example, the name blue point is now given commonly to oysters not exceeding 2 or 2½ inches in length.

Oysters are especially valued for their iron, copper and iodine content. They also contribute some calcium and phosphorus and fair amounts of the B complex and vitamins A and C. The use of oysters is sometimes recommended in the diet for pernicious anemia. As the caloric value is low, oysters are used in the general diet particularly on account of their flavor and their digestibility. Raw oysters rank first on this count. When cooked, the cooking period should always be short to avoid toughness.

Oysters may be contaminated by water polluted by sewage. The water in which oysters are grown should be examined frequently to ensure the safety of the output. Oysters may also become contaminated in the process of shucking or shelling, because of improper handling. Stiles found enormously greater numbers of bacteria in shelled than in unshelled oysters. Since typhoid organisms have been found in oysters, after even eight weeks of cold storage, cooking is a necessary precaution, unless the oyster beds are supervised and examined regularly, as is customary under the laws of a number of coastal states. The temperature at which oysters are cooked, however, is usually sufficient to destroy pathogenic bacteria.

Oysters in the shell may be served raw, broiled or baked, and out of the shell stewed, creamed, scalloped, fried and roasted. In choosing oysters those with tightly closed shells should be selected. The oysters should have a good odor, should not be ropy or slimy, and should not be "bloated" by placing them in fresh water.

CLAMS

Clams rank next to oysters in popularity. They are of two kinds, hard and soft shell. They are found just below the surface of sand and mud at low tide and are dug with shovel and rake. The long soft-shelled clams are found abundantly on the New England coast. The round hard-shelled clams, called quahaugs, are found from New York to Florida. The very small round clam is known as the little neck.

Clams are most abundant during the closed oyster season. Little neck clams are served raw and often take the place of blue points on hotel and restaurant menus. They do not differ much from oysters in food value.

Clams are lower in minerals and vitamins than oysters.

Quahaugs or large clams are used for chowder, broth and frying. Soft-shelled clams are boiled, steamed and used in chowders. In choosing clams, those with unbroken shells should be selected. If open, they should close quickly when touched and have a good odor. The sanitary precautions given for oysters should apply to clams, mussels and scallops.

MUSSELS

Mussels are not generally used for food in the United States, but are used extensively in France, Holland and England. They are found in both fresh and salt water.

SCALLOPS

Scallops, like oysters, are bivalves, but only the muscle which opens and closes the shell is used for food. Two types of scallops are found in the waters of the Atlantic and the Gulf of Mexico. Those which are found in shallow waters are smaller and more tender than the deep-sea scallops. Scallops are sold by the quart or pound and may be broiled, fried, baked or used for chowder. They have a comparatively high mineral and vitamin content.

LOBSTERS

Lobsters are salt-water crustaceans and are found in Atlantic waters from Newfoundland to New Jersey. They are most plentiful in summer. The average lobster of the present day weighs only about two pounds, one half of which is edible. Lobsters have a dark-greenish hard shell which turns red during cooking.

Live lobsters heavy for their size should be chosen. There should be an active, quick response to touch. After boiling, the tail should spring back when straightened out. This test shows that the lobster was alive before cooking. Lobsters may be served boiled, baked, creamed or broiled.

Frozen crawfish, known as lobster tails, from South Africa and the West Indies is also available in some markets.

CRABS

Several types of crabs are found along the Atlantic and the Pacific coasts. Soft-shelled crabs are small Atlantic crabs which have shed their shells. They are usually cooked whole. The meat of the hard-shelled crab is usually picked after boiling and shipped packed in ice or canned. Most of the canned crabmeat comes from the large crabs of the Pacific Ocean, although some is now coming from Atlantic waters. Crabmeat supplies a fair amount of minerals and vitamins.

SHRIMPS

Shrimps from Southern waters, which are used commonly, actually belong to the prawn family. True shrimps are found to some extent along both the Atlantic and the Pacific coasts. A large amount of the tail meat of the Southern shrimp is canned and furnishes the principal supply. In this form shrimp is used for salads, cocktails and luncheon dishes. Shrimps rank next to oysters in mineral content and supply some vitamins. By reference to the table of composition of shellfish, it will be noted that they are all of approximately the same composition, varying in fuel value from 335 to 435 calories per pound. They are low in fat and contain from 10 to 17 per cent protein.

Shrimps may be fried, scalloped or creamed. Canned shrimp, as already mentioned, is used largely in making salads.

OTHER FOODS GROUPED WITH FISH

Turtles. Both fresh- and salt-water turtles are used. The green turtles grow to an enormous size, some weighing from 50 to 100 pounds. They are used principally for making soups, some of the flesh being included in the soup. No work has been done on the vitamin or mineral content.

Terrapins. Terrapins are found in fresh and salt water and are shipped from the South packed in seaweed. They are in season from November to April. Like the lobster, they are cooked alive. Because of the scarcity of terrapin and the increased cost (from two to seven dollars each), they are used very little. The diamondback terrapin is the most famous variety. Only the female is used for food, the choicest or "full cow" terrapin containing eggs. Terrapin is prized for its delicate flavor and is easily digested.

Frogs' Legs. Frogs' legs are utilized in some parts of the United States, only the hind legs being eaten. They are easily digested and have a very delicate flavor, much like the white meat of chicken. They are served broiled or fried.

DIGESTIBILITY

Fish, in general, is easily digested because of its short and tender muscle fibers. The controlling factor of digestibility as far as fish flesh is concerned is its fat content; in the richer varieties the fat delays food passage through the stomach, which may be an important consideration in some dietary conditions. If fish low in fat is desirable, charts of "approximate composition" may be consulted. The method of preparation may also be a factor in digestibility, especially when fat is not well tolerated.

Shellfish vary greatly in the rapidity with which they are digested. Oysters are among the most valued foods for the invalid because they digest easily. Lobster is seldom used in the invalid diet because of the coarseness of the meat and the strong flavor. Other shellfish are usually well tolerated, although there may be allergies toward one or more of the members of the shellfish family and occasionally to other types of fish as well.

PLACE IN THE MENU

Fish and shellfish may be used to advantage in the invalid's diet if the patient likes this type of food. The texture of fish is so tender that it may be introduced as soon as solid food is allowed. Fish such as salmon and shad, whose flesh contains fat, is sometimes reserved for later use. Oysters are used more than any other shellfish, although clams, crabmeat and shrimp will offer a desirable variety during the latter part of convalescence. Lobster may have a place on a tray prepared for a convalescent patient under no dietary restrictions.

SELECTION AND CARE OF FISH

Fish is offered on the market today in a number of different forms. Coastal cities and regions bordering on the Great Lakes are well supplied with fresh fish, which is carefully packed in ice for distribution. Fish frozen quickly near its source is kept in cold storage until there is a demand for it. In addition, fish fillets packed in cartons before freezing are available in many markets. Frozen fish should not be defrosted until just before it is to be used. When this is done at market, the test for frozen, as well as for fresh, fish should be firm flesh and lack of a strong odor. Fish should be stored in a covered utensil in the refrigerator. When frozen fish is bought in cartons of family size, it should be allowed to thaw on the shelf of the refrigerator or at room temperature for a number of hours, then cooked promptly. Cartons which arrive in the home kitchen frozen hard may be stored in the freezing unit of the refrigerator for a few hours until required. Canned fish should be stored in a dry cool place, and the cans should not be opened until just before the fish is to be used. Quantities of fish are still prepared for shipping by the oldest methods of food preservation—drying, smoking, salting and pickling. By such methods fish will keep in good condition a long time. Fish so treated is generally purchased at store when it is to be used, although it may be kept at home when good storage conditions are available.

FISH RECIPES

The general rule for cooking fish may be summed up in one sentence: Short cooking just before serving is most important. This rule is particularly applicable in the case of broiled and pan-broiled fish, which after cooking dries out quickly. The test for cooking is simple. When tried with a fork, the flesh should flake. Sliced or quartered lemon is the chosen garnish for fish, both for appearance and flavor. If a sauce is used, it should be flavored either with lemon or some other pungent ingredient.

Fish, Baked Fillets

Procedure: Wash fish fillet and wipe with cloth. Dip in milk, sprinkle with salt and roll in fine, dry bread crumbs or rolled cornflakes. Place in a small, greased baking pan, sprinkle with melted butter or salad oil and bake in a very hot oven (500° F.) 10 minutes or until well browned. Serve with tartare sauce in a lettuce cup, if desired, and lemon quarter.

To make tartare sauce: Mix 1 teaspoon finely minced olives or pickles and a few drops onion juice with 1 tablespoon mayonnaise.

Broiled Fish

Procedure: Wash fish thoroughly, wipe with cloth. Brush with melted butter or salad oil, sprinkle with salt and pepper. Place skin side down on well-greased broiler rack, broil 2 inches from heat from 10 to 15 minutes (until brown). The flesh should flake when tried with a fork. Serve with melted butter and sliced lemon. Allow 1 small fish or ⅓ lb. fish fillet for each serving.

Pan-broiled Fish

Procedure: Wash fish thoroughly and wipe with cloth. Roll in seasoned flour, corn meal or fine dry crumbs. Melt 1 tablespoon butter or bacon fat in a small heavy frying pan and sauté fish over moderate heat until brown on one side. Turn with a pancake turner and brown the other side. Allow from 8 to 10 minutes for cooking. Dress with melted butter or minced parsley.

Poached Fish (Boiled Fish)

Ingredients:

1 teaspoon butter
1 teaspoon chopped celery
1 teaspoon chopped carrot
1 sliced onion
1 peppercorn
½ teaspoon salt
1 teaspoon vinegar
2 cups water
½ pound fish fillet

Procedure: Melt butter, add vegetables and cook ½ minute. Add seasonings, vinegar and water. Cover and bring to boiling point. Boil 5 minutes. Wash fish, tie in cheesecloth, place in water and let simmer from 20 to 30 minutes, until fish flakes when tried with a fork. Remove from cheesecloth and drain. Serve with egg, cheese or hollandaise sauce (see Sauces for Vegetables, p. 521) or chill and flake for use in recipes for creamed or scalloped fish (see p. 508). Yield: 1 generous serving.

Egg Sauce for Fish

Ingredients:

1 tablespoon butter or margarine
1 tablespoon flour
⅓ cup fish stock
¼ cup sweet or sour cream
2 teaspoons lemon juice
½ hard-cooked egg
1 teaspoon minced parsley

Procedure: Melt butter or margarine in small saucepan, stir in flour. When well blended, stir in the stock. Continue stirring over low heat until mixture thickens slightly. Add cream and stir until sauce boils. Add lemon juice and hard-cooked egg white cut into pieces. Add salt, if needed. Reheat and pour over poached fish fillet. Sprinkle with sieved hard-cooked egg yolk and minced parsley.

Note: Milk may replace the cream if a less rich sauce is desired.

Creamed Fish

Ingredients:

1½ tablespoons butter
1½ tablespoons flour
¼ teaspoon salt
Pepper
¾ cup top milk
½ cup flaked fish
Nutmeg
1 tablespoon minced parsley or chives

Procedure: Leftover cooked fish or canned tuna fish, salmon, crabmeat or shrimp may be used. Melt butter, stir in flour, salt and pepper. When well blended, add milk slowly, stirring constantly over low heat until the mixture thickens and boils. Add fish, nutmeg and more salt if necessary. One teaspoon lemon juice may be added if desired. Reheat, serve on toast or in patty shell. Sprinkle with minced parsley or chives. Yield: 2 servings.

Creamed Fish with Mushrooms

Procedure: Follow directions for creamed fish (see above), adding 2 tablespoons sliced cooked or canned mushrooms with the fish.

Codfish, Creamed

Ingredients:

½ cup salt codfish
½ cup cream sauce (p. 521)

Procedure: Soak codfish in cold water 20 minutes to remove some of the salt; drain. Cut in small pieces and combine with cream sauce, from which salt has been omitted, and heat thoroughly. Yield: 1 serving.

Scalloped Fish

Ingredients:

2 tablespoons butter
1 cup soft bread crumbs
¼ teaspoon salt
Pepper
2 teaspoons lemon juice
½ cup flaked cooked or canned fish

Procedure: Leftover cooked fish or drained canned tuna fish or salmon may be used. Melt butter, add crumbs and stir with a fork until well mixed. Add salt, pepper and lemon juice. Arrange fish and crumbs in alterante layers in a small, greased baking dish. Bake about 5 minutes in a hot oven (450° F.) until crumbs are golden brown. Yield: 2 servings.

SELECTION AND CARE OF SHELLFISH

Great care must be taken in the handling and the preparation of shellfish for shipment. Fresh lobsters, oysters and clams are packed in ice and shipped alive to market points. They are kept alive until purchased. Some crabs are handled in the same way; picked fresh crabmeat is often packed in cartons and shipped in ice. Shrimps (fresh but not alive) are packed in ice for shipment. Lobsters, crabs and shrimps are canned extensively; oysters are also canned to some extent, and recently clams have been put on the market in this form. Shellfish are also preserved by means of the quick-freezing process. In this case the products are removed from the shells and frozen at a temperature far below zero. They are kept at a temperature below freezing during shipment and at market until sold. They must be used within a few hours of purchase.

SHELLFISH RECIPES

Creamed Oysters

Ingredients:

1½ tablespoons butter
1½ tablespoons flour
¼ teaspoon salt
Pepper
½ cup milk
6 oysters
1 tablespoon diced raw celery

Procedure: Melt butter in a small saucepan, stir in flour, salt and pepper; stir in milk gradually and continue stirring over low heat until sauce thickens and boils. Add drained oysters and celery and cook over low heat about 2 minutes until edges of the oysters curl. Serve on hot toast or in patty shell; garnish with strips of pimiento or minced parsley. Yield: 1 serving.

Panned Oysters

Ingredients:

6 oysters
½ tablespoon butter
Salt
Pepper

Procedure: Drain the oysters, pour into hot dry saucepan and cook, stirring constantly until edges curl. Add butter and seasoning. Serve on toast. Yield: 1 serving.

Scalloped Oysters

Procedure: Follow directions for scalloped fish (p. 508), substituting 6 raw oysters for the flaked fish.

Baked Oysters Casino

Ingredients:

6 oysters, in shells
1 tablespoon finely minced green pepper
1 strip bacon, finely minced
½ tablespoon lemon juice
Dash pepper

Procedure: Have raw oysters opened at market. Arrange on half shells on pie plate. Sprinkle each with minced green pepper, minced bacon, lemon juice and pepper. Bake in hot oven (450° F.) about 10 minutes (until edges of oysters curl). Yield: 1 serving.

Clams, Steamed

Ingredients:

1 pint clams
½ cup boiling water
2 tablespoons butter, melted
1 teaspoon lemon juice

Procedure: Scrub clams with brush and wash under running water until sand has been removed. Place in kettle with boiling water, bring to boiling, cover and cook over low heat from about 12 to 15 minutes (until shells open). Serve on a hot platter and cover with a napkin. Mix melted butter with lemon juice and pour into small cup. Strain clam broth into a bouillon cup. Yield: 1 serving.

Scallops, Baked

Procedure: Wash and drain ¼ lb. scallops. Roll in seasoned fine dry bread crumbs. Arrange in small, greased, shallow baking dish. Sprinkle with melted butter or with 1-inch pieces cut bacon. Bake under broiler about 4 inches from moderate heat about 10 minutes.

Scallops, Scalloped

Procedure: Follow directions for scalloped fish (p. 508), substituting ½ cup whole bay scallops or ½ cup cut sea scallops for the flaked fish.

Shrimps en Brochette

Procedure: Arrange cooked shrimps alternately with 1-inch pieces bacon on metal skewer. Broil about 3 inches from heat for 5 minutes, until bacon is crisp, turning occasionally. Garnish with lemon quarter. Allow 4 or 5 shrimps for 1 serving.

REVIEW QUESTIONS

1. Compare fish and meat for food value and flavor.

2. Name several types of fish that could be used when necessary to keep fat intake low.

3. Which shellfish most commonly appear on the menu? Which are chosen most often for the convalescent diet, and why?

4. Give the principles for the selection and the care of fish.

5. State the principles for cooking fish.

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Vegetables

Chapter Topics

BOTANICAL CLASSIFICATION	PREPARATION AND COOKING
FOOD VALUE	GENERAL RULES FOR COOKING
DIGESTIBILITY	TIME TABLE FOR COOKING
CANNED VEGETABLES	DRESSINGS
FROZEN VEGETABLES	FLAVORED BUTTERS
DEHYDRATED OR DRIED VEGETABLES	SAUCES
PLACE IN THE MENU	MISCELLANEOUS RECIPES

Under the term vegetables are grouped foods representing practically every part of edible plants, such as leaves, seeds and seed pods, flowers, roots, tubers and fruits. The realization that vegetables had an important contribution to make to the diet spurred research work in nutrition and resulted in their being classified under four of the Seven Basic Food groups considered essential for daily use. Under Group 1 are listed all which have a characteristic green or yellow color. In Group 2, salad greens, cabbage and tomatoes are listed with citrus fruits. In the form of legumes, such as dried beans, peas and lentils, are vegetables in Group 5 with meat and other contributors of protein. The remaining vegetables are classified in Group 3 with fruits other than citrus and tomatoes. In addition to their nutritive quality, vegetables are valued because of the variety they give to the diet through texture, flavor, odor and color. (See Chap. 2.)

BOTANICAL CLASSIFICATION

Botanically vegetables fall into different classifications according to plant structure. This does not, however, indicate in general their nutritive value.

Leafy Vegetables. The leafy vegetables—often called green vegetables—contain less than 10 per cent of solid matter. Outstanding members of the group are spinach, cabbage, Brussels sprouts, lettuce and greens of all sorts.

Stem Vegetables. Celery, asparagus, leeks and rhubarb are classed as stem vegetables, although rhubarb is generally considered a fruit because of the need of sugar in its preparation and because of the way in which it is used in the menu. Kohlrabi is a combination of stem and root.

Roots and Tubers. Vegetables which grow underground are classified as roots and tubers. Of these, beets, carrots, salsify, turnips, sweet potatoes and parsnips are true roots. White potatoes, Jerusalem artichokes and peanuts, the last used almost entirely as nuts, are tubers or underground stems. Onions are actually bulbs.

Flower Vegetables. Cauliflower and broccoli are examples of the flower type of vegetable. The tips of asparagus are flower buds. Brussels sprouts might be classified as a flower or as a leafy vegetable.

Fruits Classed as Vegetables. Vegetables which are essentially the fruits of the plants are tomatoes, peppers, cucumbers, squashes, pumpkins and eggplants.

Seeds and Seed Pods (Legumes). Peas, beans and lentils are classified as legumes. All are found in seed form, encased in pods. Both pods and seeds of young beans are eaten in the form of snap beans. Peas and some beans are shelled and used as green vegetables. In dried form, peas, beans and lentils are largely used and, unlike other vegetables, serve as a meat substitute on account of their high protein content. Soybeans, which are high in both protein and fat, differ from other legumes. Grains which are used for flour and other cereal products are also seeds.

Edible Fungi. The fungi are plants characterized by an entire lack of chlorophyll, the green coloring matter which enables plants to make food from the carbon dioxide of the air. The edible varieties are commonly known as mushrooms; the inedible are popularly called toadstools, especially the injurious ones, many of which are extremely poisonous. Recent research as to the food value of cultivated mushrooms shows that they contain protein similar to the gliadin of wheat. They provide appreciable amounts of copper and iron and several fractions of the B complex.

FOOD VALUE

In general, vegetables are valued more highly for their vitamin contribution than for their other nutrients. They differ greatly in this respect, but almost all vegetables supply vitamin A, ascorbic acid, riboflavin and niacin in amounts large enough to be included in vitamin tables. Green and yellow vegetables are the best sources of carotene, the provitamin A. First on such a list are dandelion greens, carrots, turnip greens, spinach, sweet potatoes, kale, beet greens, collards and mustard greens. Next in order come winter squash, broccoli, chard, lettuce, tomatoes, asparagus, green peas and string beans. (See Fig. 18, Chap. 8.) White celery and peeled cucumbers are lacking in this vitamin, but Pascal celery when it has been studied will probably be found to be as rich as its color would indicate, and it is already known that unpared cucumbers supply vitamin A.

Vegetables in general are a more important source of ascorbic acid than has been recognized, as almost all contribute at least a small amount. The tomato is the most important source, not only because of its natural high content but because this is not destroyed by the canning process. Because tomatoes are used so much, they are more important in the meal plan than some other vegetables which are not eaten daily but which may rate higher in ascorbic-acid content. The best contributors in order of ascorbic acid content are turnip greens, green pepper, broccoli, kale, mustard greens and Brussels sprouts. Cauliflower, spinach and cabbage come next in order. Potatoes, white or sweet, while less high in vitamin C than some of the other vegetables, are used in such quantities that they add materially to the total of the day. This is also true of lettuce and other salad greens when they are used often. (See Fig. 21, Chap. 8.)

As can be seen by consulting Table 1, Part Four, and figures in Chapter 8, vegetables supply varying amounts of thiamine, riboflavin and niacin of the B complex group. Again greens are high on the list as a source. Peas and potatoes also rate well. Even when amounts are small, vegetables as a class play a part in the accumulation of the daily total of the B complex.

Vitamin Loss in Cooking. The losses of vitamins in the cooking of vegetables are exceedingly variable, depending upon the type of vegetable and the method of cooking. Furthermore, available data are meager and difficult to evaluate. The per cent of loss may be materially reduced by cooking in little water only until done and by using the cooking water. To give some idea of the losses to be allowed for, even when preferred methods of cooking are used, the following general estimates have been derived from the Food and Nutrition Board [1] figures. (For the vitamin content of raw vegetables and some cooked figures see Table 1, Part Four.)

Mineral Content. The mineral content of vegetables is significant in the diet. The calcium, the phosphorus and the iron make them as a class useful contributors to the specific needs of the body for these minerals. At the same time, the alkaline residue which they leave after digestion and absorption tends to balance the acid residue of meats and cereals and thus aids in maintaining the neutrality of the blood. Reference to Table 1, Part Four, will show that legumes—under which heading are included dried beans and peas and lentils—have particularly high mineral value. This will, of course, be reduced per serving after they have been soaked and cooked, but they are still good sources. Potatoes, because they are eaten so often, make a larger contribution of minerals than their analysis shows.

AVERAGE VITAMIN LOSSES IN THE COOKING OF VEGETABLES

(Per cent loss includes *dissolved* plus *destroyed*)

Vegetable Type	Carotene	Thiamine	Riboflavin	Niacin	Ascorbic Acid
Leafy green	20	25	25	25	45
Other green types (Broccoli, asparagus)	10	10	20	15	25
Yellow types (carrots, sweet potatoes)	10	25	. .	15	15
White potatoes					
boiled	. .	20	25	20	20
baked	. .	. .	. .	. .	55
mashed		. .	. .	. .	50
Beans and peas					
fresh or frozen	15	20	25	20	40
canned	45	40	35	. .	45

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[1] Food and Nutrition Board, Table of Vitamin Losses in Cooking, 1944.

Leafy green vegetables are naturally high in mineral content, but not all of this is available. Knowledge of the availability is at present inadequate. The utilization of the calcium depends upon the amount of oxalic acid present. While greens score well in the case of iron, it may be only partially available. The mineral content may be influenced by the type of soil in which vegetables are grown. This is illustrated particularly in the case of iodine (see Chap. 7). When vegetables are cooked, there may be some loss of minerals in the cooking water. This is another reason why a minimum amount of water should be used and the vegetable liquor either served with the vegetable or used in a sauce.

Protein is to be found in the dried legumes in a quantity which qualifies them as a substitute for animal protein. However, its quality is not so high, and it is not so well utilized in the body. Soybeans are in a somewhat different classification as their caloric value is chiefly in the form of protein and fat, and they are almost starch-free. The quality of the protein is good and its comparative value is being studied further. While the percentage value of the protein in most fresh vegetables is not high, it is enough to be considered. According to Sherman,[2] ". . . they show as much or more of their total calories in form of protein as is customary or desirable in ordinary dietaries."

Caloric Value. The caloric value of vegetables is generally in ratio to water content. The range in value is from young fresh greens through potatoes to dry legumes. Except in the case of the legumes, which are comparatively high in protein as well as in carbohydrate, the caloric contribution is generally supplied by the starch con-

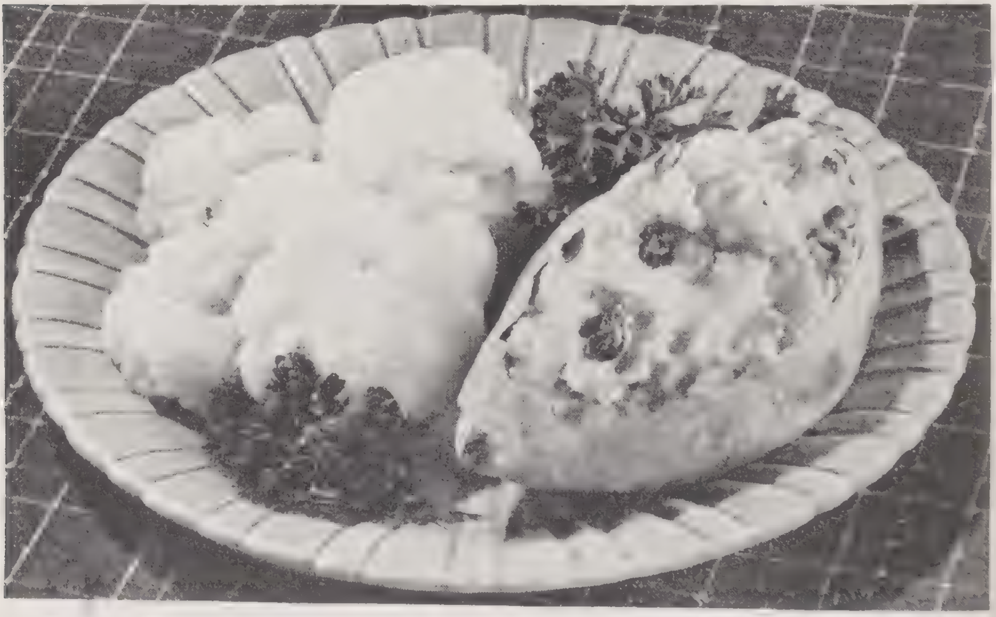

FIG. 113. A vegetable plate showing a golden sweet potato or yam with delicate white cauliflower.

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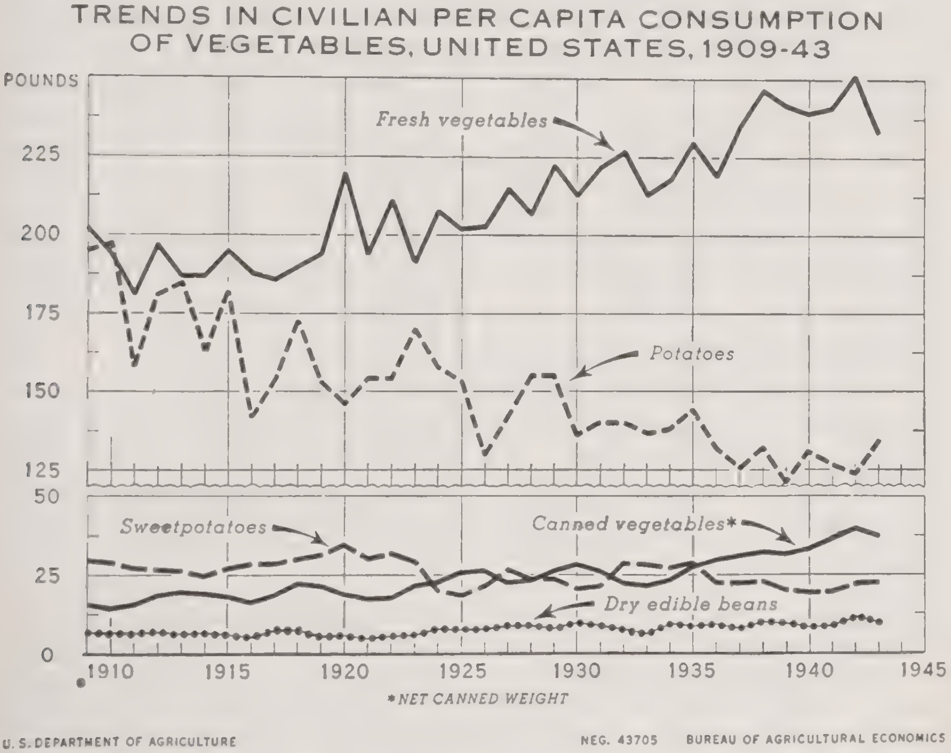
[2] Sherman, H. C., and C. S. Lanford: An Introduction to Foods and Nutrition, p. 130, New York, Macmillan, 1943.

tent, in which potatoes are particularly high. A few vegetables, notably beets and sweet potatoes, are comparatively rich in sugar. Certain young vegetables, such as peas and corn, have carbohydrate in the form of hemicellulose, which are useful as bulk in aiding peristalsis. It is often an asset to be able to introduce into the intestinal tract a sufficient amount of indigestible residue without unduly increasing the daily caloric intake.


TRENDS IN CIVILIAN PER CAPITA CONSUMPTION OF VEGETABLES, UNITED STATES, 1909-43

*NET CANNED WEIGHT

U. S. DEPARTMENT OF AGRICULTURE NEG. 43705 BUREAU OF AGRICULTURAL ECONOMICS

FIG. 114. The per capita consumption of fresh vegetables, including melons, has increased about one-sixth since 1909 while the consumption of commercially canned vegetables more than doubled. On the other hand, per capita consumption of potatoes decreased about one-third during the period 1909-43 and sweet potato consumption declined about one-fourth.

sugar which changes to starch as the vegetables mature. Available carbohydrate, which is the sum of starch, dextrin and sugar, has been determined for many common vegetables, but data are still incomplete. The percentage of fat in vegetables is very low, except in the case of soybeans.

Almost all vegetables contain large amounts of the nondigestible forms of carbohydrate known as cellulose and hemicellulose, which are useful as bulk in aiding peristalsis.

Recent research has shown that the food value of vegetables is dependent to some extent upon the type of soil, the methods of fertilization and the varying conditions of the season. Experiments are now being conducted with a view to improving growing methods, and it is hoped the result eventually will be the production of vegetables higher in vitamin and mineral content than those available today.

New and better methods of packing and distributing are also under study. An adequate supply of vegetables gives to the diet what is called "the factor of safety" with reference to vitamins and minerals, but with the many variable conditions affecting quality, the vegetable content of the diet must be abundant in order to be adequate.

DIGESTIBILITY

The normal person can digest vegetables easily. Tender young vegetables are often served raw as relishes or salads. To the standard list of salad vegetables, which include greens, tomatoes, cucumbers, celery, cabbage, onions and radishes, have now been added thinly sliced carrots, green peppers, turnips and flowerets of cauliflower. However, discretion should be used in offering a convalescent patient salads and relishes of pungent flavor.

Discretion should also be shown in serving cooked vegetables, as some which can be taken under conditions of normal health may cause distress during illness.

Alvarez and Hinshaw,[3] who made a survey of foods that gave distress to their patients, found that the following vegetables were frequently reported as causing "gas, belching, flatulence or distention": Onions, cabbage (and other members of the cabbage family), radishes, dried beans, cucumbers and lettuce. Others less frequently reported were melons, tomatoes, corn and peppers. Under certain conditions when roughage must be avoided, it may be necessary to serve vegetables in puréed form. The puréed vegetables designed for feeding infants will be found a convenience in this case.

CANNED VEGETABLES

Canned vegetables provide out-of-season products which contribute practically the same food value as cooked fresh vegetables. Canning factories are distributed throughout the country in the center of producing districts. The products are picked as soon as they have reached the proper stage and are taken immediately to the factories, where they are cleaned, prepared and packed at once into cans or glass jars, which are then subjected to pressure heat. The scientific methods used for the preservation of perishable foods guarantee that the products will be safe and wholesome.

FROZEN VEGETABLES

Quick-frozen vegetables are now widely accepted as equal or superior in food value to fresh vegetables other than those freshly picked from the garden. Ready as they are for cooking, they have proved a great convenience. The distribution of commercial products has widened every year as dealers became convinced that it was worth while to purchase the refrigerated equipment necessary for their storage. In large cities, stores which deal only in frozen products are increasing in numbers. Many towns offer locker facilities where green vegetables and other products may be frozen and stored at the necessary low temperature. There is an increasing use of the home freezer for this purpose by those who raise their own products.

Frozen products, fresh and of good quality, prepared and packed properly for freezing, lose little of their natural food value during storage at the proper temperature.

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[3] Alvarez, W. C., and H. C. Hinshaw: J.A.M.A. **104**:2053, 1935.

DEHYDRATED OR DRIED VEGETABLES

Dehydrating by some means of drying is the oldest method of preserving vegetables. Except in the case of the legumes such as peas, beans and lentils, this process had been superseded largely by canning and freezing until war demands for conservation of space in shipment created a new interest in dehydrated products. Many research projects in the interest of preserving flavor, texture and vitamins of vegetables and some fruits were undertaken with varying success. These products were known as dehydrated foods in contrast with dried beans and peas. As with the latter, it is necessary to reconstitute them by soaking in cold water for a specified time before cooking. A method for anhydrating foods by a quick process is now being developed. This will allow the products to be reconstituted without soaking.

PLACE IN THE MENU

A well-rounded menu will have vegetables in some form at both midday and evening meals. Effort should be made to serve at least two vegetables besides potatoes, one of them in raw form as a salad or relish. In the Seven Basic Food Plan one green or yellow vegetable is suggested for daily use. When a variety of such vegetables is not available, a double portion of any leafy green vegetable in salad form may be used.

PREPARATION AND COOKING

Under modern conditions of growing, shipping and distributing, almost all fresh vegetables can be found in market throughout the year, regardless of season. To supplement the fresh vegetables which are shipped from the South and the Far West to markets thousands of miles away and the local products which are in season, there are as well the quick-frozen vegetables, the quality and the price of which are stable throughout the year. In addition, there is an ever-increasing variety of canned vegetables. With so much from which to choose there is no reason, except a dislike of certain products, why the menu should not be varied daily so far as vegetables are concerned.

As it may be important to introduce as many vegetables as possible, a prejudice may sometimes be overcome by persuading the patient to taste a vegetable which has hitherto been refused. If the patient has been accustomed to overcooked cabbage, for instance, he may be surprised to find that he likes that crisp light-green or creamy-white vegetable which appears on his tray. On the other hand, one badly cooked vegetable may cause the patient to lose interest in this important asset to diet.

The selection of vegetables for the invalid's tray should be made with reference to the family meals. It is possible, however, to buy many vegetables in small quantities and to prepare them especially for the patient.

The care of vegetables in the home kitchen, for use in either raw or cooked form, is an important matter. The length of time which they will keep in good condition depends upon the type and upon the facilities for storage. Root crops, such as turnips, potatoes, carrots and beets, lose their ascorbic-acid content slowly, but they should preferably be kept in a dark, dry, cool place. Large vegetables, such as cabbage, squash and pumpkin, retain their vitamin content better than the leafy vegetables and the small ones such as string beans. Vegetables such as peas and Lima beans should not be shelled until just before they are to be cooked if a large loss is to be avoided. All green vegetables show less loss under refrigeration than under room temperature. Experiments show that when stored in the refrigerator salad greens, celery, young carrots, peas, radishes, parsley, broccoli, cauliflower and tomatoes should be covered, while cucumbers, green and Lima beans, eggplant and summer squash may be left uncovered.

For detailed directions for vegetables to be served raw, see next chapter on salads and relishes.

Vegetables should be washed thoroughly to remove soil and traces of spray. Root vegetables should be scrubbed; asparagus, spinach and other greens should be washed under running water to remove sand. Vegetables such as potatoes and carrots should not be pared or scraped until just before they are to be used. Peas and beans should not be shelled or corn husked until just before they are to be cooked. Outer leaves of cauliflower and cabbage should not be removed until just before they are to be used. In soaking vegetables in salted water to draw out insects, only a few minutes should be allowed. Soaking should be done before cutting or shredding. A larger loss of vitamins occurs when vegetables are cut in small pieces. Grated carrots, for instance, lose vitamins more quickly than the sliced vegetable.

When possible, vegetables should be cooked before they are pared or

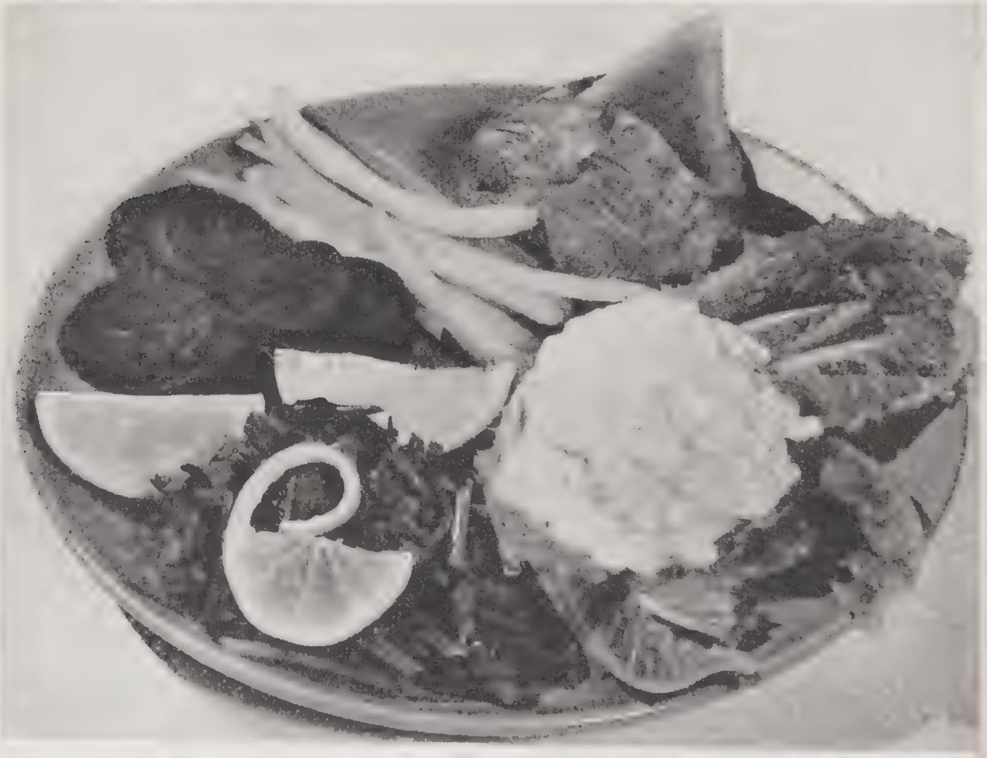

FIG. 115. A vegetable plate with baked potato, hot sliced beets, beet greens garnished with lemon, carrot strips and cottage cheese.

scraped, although the longer the time necessary for cooking, the greater the loss of minerals and vitamins. Whole potatoes and carrots demand a longer time to cook than those which have been sliced. All vegetables should be cooked as short a time as possible, as long cooking destroys vitamins and changes flavor, color and texture. Only a small amount of water should be used when vegetables are boiled. There will be a very small amount of evaporation if the utensil is tightly covered and if cooking is done over low heat. A heat-proof glass pot will demonstrate this fact, although the same results are achieved by any type of saucepan when the cover really fits it. Only a small amount of salt will be needed, and this will be in proportion to the amount of water used. Cooking should be done over low heat, and if steam escapes between the pan and the cover, heat should be lowered further.

The use of baking soda in the cooking of green vegetables has been frowned upon by nutritionists, because an alkali such as soda is known to hasten destruction of the vitamins of the B complex and ascorbic acid. Good cooks have also objected to the use of soda because of the loss of natural flavor and texture. Some research work done at the University of Southern California showed that a very small amount of soda had no effect upon the vitamin content of peas cooked a minimum time which was shortened by the use of the soda. It is not known as yet whether other vegetables react in the same manner. However, the practice of adding soda is not recommended, because both in the home and in institutions, vegetables are apt to stand for a time before being eaten, and if left over and warmed up the soda tends to increase vitamin losses and still further affect flavor and texture.

GENERAL RULES FOR COOKING

1. Use just enough water to cover bottom of pan to a depth of ¼ inch. Spinach and other tender greens need no water.
2. Bring water to boiling point and add salt before vegetable is added.
3. Cover and cook only until vegetables are tender.
4. Do not drain the vegetables of mild flavor after cooking, unless the liquid is to be used in the preparation of a sauce.
5. Vegetables may be baked in tightly covered casseroles when the oven is being used for some other purpose. The time of cooking will be about one and a half times again as long as for boiling.
6. Variations from the general rules: Whole cauliflower and whole cabbage should be placed head up in the utensil, and the amount of water should be increased to ½ inch. Broccoli on the stem needs to be covered with water to retain color. The cut flowerets may be cooked in the same way as whole cauliflower. Bunched asparagus may be cooked in the lower part of the double boiler, the top being used as a cover. The water should be increased to a depth of 2 inches. Corn on the cob will need water to a depth of an inch.
7. The use of a small pressure cooker for cooking vegetables will shorten the time. Directions with the utensil should be used.

TIME TABLE FOR COOKING

As vegetables differ in texture according to maturity, directions for cooking time can only be approximate.

Vegetable	Minutes
Artichokes	
American or Jerusalem	15–20
French or Globe	20–30
Asparagus	15–20
Beans	
String	15–30
Lima	20–30
Beets	20–60
Beet greens	10–20
Broccoli	15–25
Brussels sprouts	10–20
Cabbage	5–10
Carrots	15–30
Cauliflower	10–30
Celery	10–15
Corn	5–10
Cucumbers	10–15
Dandelion greens	10–20
Eggplant	10–15
Kohlrabi	20–30
Mushrooms	7–10
Okra	20–25
Onions	20–40
Parsnips	30–50
Peas	8–15
Potatoes	
White	20–30
Sweet	20–30
Spinach	6–10
Squash	
Summer	10–20
Winter	20–30
Turnips	15–60

General Directions for Frozen Vegetables

Frozen vegetables are packed in cartons, and if not to be used within eight hours should be placed in the freezing compartment of the refrigerator, where they will remain solidly frozen. They need not be thawed before cooking. If they have thawed, no attempts to refreeze them should be made. Quick-frozen vegetables may be cooked according to directions for other fresh vegetables. Place in boiling salted water, cover and continue cooking until tender. The time of cooking is generally a little shorter than that indicated for fresh green vegetables.

General Directions for Canned Vegetables

As canned vegetables are already thoroughly cooked, they need only heating and dressing to make them ready for the table. The liquid from the can may be drained and boiled 2 or 3 minutes in order to evaporate some of it. The vegetables may then be heated in this liquid. Canned tomatoes are of course an exception, as they are canned in their own juice.

General Directions for Dried Vegetables

Dried vegetables most commonly used are beans, peas and lentils. In some localities dried mushrooms are obtainable. Most dried vegetables need to be soaked before they are cooked. Any exception to this rule will be noted on the package and the time given for cooking.

DRESSINGS

Vegetables may be dressed with melted butter, brown butter or lemon butter, with cream or with a sauce. Butter and cream are used more often with vegetables than any other dressing. Vegetables cooked in a small amount of water need not be drained. When ready to serve, add 1 or 2 tablespoons butter or 2 tablespoons cream to each cup of cooked vegetable and reheat. For such vegetables as asparagus and broccoli the sauce often serves as a garnish and is poured over the vegetable just before it is served. Sauces of this type may be served in a separate dish if desired.

Flavored Butters

The butter may be melted and combined with lemon juice to taste before the vegetable is dressed. Spinach, string beans, cauliflower, broccoli, asparagus and beets may be dressed with lemon butter. Minced parsley may be added with the butter for dressing potatoes. Cut mint leaves may be used with peas. Butter may be browned slightly in a separate utensil and poured over such vegetables as cauliflower, broccoli or asparagus. A few grated dry bread crumbs may be browned in butter for dressing cauliflower, broccoli, asparagus and onions.

SAUCES

Sauces should blend or contrast in flavor with the vegetable with which they are to be served. They must be smooth and not too thick. When made in a small quantity, a cream sauce may thicken more than is desired. In this case, a little more liquid may be added. A sauce should be served as soon as possible after preparation, but if for any reason it is not, it should be well beaten before being combined with the vegetable.

Cream Sauce

Ingredients:

1 tablespoon butter
2 teaspoons flour
¼ teaspoon salt
Dash pepper
½ cup milk or milk and vegetable stock

Procedure: Melt butter in a small saucepan, stir in flour and seasonings. Stir in milk gradually and continue stirring over low heat until sauce thickens and boils. Yield: 3 servings.

Note: Add extra seasoning according to vegetable. This may be minced parsley, minced chives or grated onion, finely chopped celery, grated carrot or lemon juice. For dressing potatoes or macaroni reduce flour to 1½ teaspoons.

Cheese Sauce

Procedure: Follow directions for cream sauce. When sauce has thickened stir in 2 tablespoons grated cheese.

Chestnut Sauce

Procedure: Follow directions for cream sauce. When sauce has thickened add 2 tablespoons cut roasted chestnuts.

Quick Hollandaise Sauce

Procedure: Follow preceding directions for cream sauce. When sauce has thickened combine 2 teaspoons lemon juice with 1 slightly beaten egg yolk and 1 tablespoon butter and add to sauce, stirring constantly.

Hollandaise Sauce

Ingredients:

1 egg yolk
1 teaspoon lemon juice
¼ cup butter

Procedure: Place egg yolk in a very small saucepan, add lemon juice and mix thoroughly. Add half the butter, hold saucepan over a larger pan containing hot, but not boiling, water, and stir vigorously until butter is melted. Add remaining butter, continue stirring until butter is melted and sauce begins to thicken. Remove from heat at once. Yield: 2 servings.

Rich Cheese Sauce

Ingredients:

½ cup processed cheese
2 tablespoons cream
⅛ teaspoon paprika

Procedure: Processed cheese comes in package form under various brand names and melts easily. Combine cheese, cream and paprika in a small saucepan, stir over very low heat until cheese is melted. This recipe may be useful in allergic conditions when neither flour nor milk is allowed. Evaporated milk which can sometimes be taken when there is an allergy toward fresh milk may replace the cream. Yield: 3 servings.

MISCELLANEOUS RECIPES

Creamed Mushrooms

Ingredients:

1 cup (¼ lb.) mushrooms
1 tablespoon butter
2 teaspoons flour
¼ teaspoon salt
Pepper
½ cup top milk
⅛ teaspoon onion juice

Procedure: Wash mushrooms. Remove stems and slice, discarding tough ends. Peel mushrooms if necessary. Young, tender mushrooms need not be peeled. Slice caps or leave whole. Melt butter in small frying pan, add mushrooms and cook over low heat about 3 minutes (until tender), stirring occasionally. Stir in flour, salt and pepper. Stir in milk gradually and continue stirring over low heat until mixture thickens and boils. Add onion juice. Serve on hot toast or in croustades (p. 548). Yield: 1 liberal serving or 2 small servings.

Sautéed Mushrooms

Ingredients:

1 cup (¼ lb.) mushrooms
1½ tablespoons butter
⅛ teaspoon salt
Pepper

Procedure: Prepare mushrooms according to directions in preceding recipe. Melt butter in small frying pan, add mushrooms and cook over a low heat about 3 minutes (until tender), stirring occasionally. Season with salt and pepper and serve on hot toast. One teaspoon minced onion may be cooked with the mushrooms. Yield: 1 liberal serving.

Buttered Onions

Procedure: Wash and peel 4 white onions. Melt 1 tablespoon butter in small heavy saucepan, add onions, cover and cook over low heat about 20 minutes (until onions are tender). No seasoning is needed; the flavor of the onions will be sweet and delicate. Yield: 1 serving.

Baked Potatoes

Procedure: Wash and scrub 1 medium-sized or large potato. Grease skin lightly with butter or other fat. Bake on rack of moderately hot oven (425° F.) from 40 to 60 minutes, until potato is soft when pressed with a towel. Remove from oven, break skin open, put a pat of butter in opening, sprinkle with paprika and serve at once. If there is to be a delay in serving it, cover with cloth and keep in warm place.

Baked Potatoes, Stuffed

Procedure: Bake potato according to directions in preceding recipe. Remove from oven, cut slice from side, scoop out contents with a teaspoon and put through ricer. Add 1 tablespoon butter and enough hot milk to give a creamy consistency. Add salt and pepper to taste, beat until fluffy and pile lightly in potato shell. Return to hot oven (450° F.) and bake about 10 minutes (until lightly browned). Yield: 1 serving.

Mashed Potatoes

Procedure: Scrub 2 medium-sized or 1 large potato. Boil in salted water until tender. Drain, peel and put through ricer. Add 1 tablespoon butter and enough hot milk to give a creamy consistency. Add salt and pepper to taste, beat until fluffy and serve at once. Yield: 1 serving.

Stewed Potatoes

Ingredients:

1 tablespoon butter
¾ cup diced cooked potatoes
¾ cup top milk
Salt, pepper
1 teaspoon minced parsley

Procedure: Melt butter in small heavy frying pan, add potatoes and stir over low heat until butter is absorbed. Add milk and cook over low heat about 10 minutes until mixture is thick. Add more milk if necessary. Season to taste with salt and pepper. Sprinkle with parsley. Yield: 1 serving.

Spinach

Procedure: Remove roots and other leaves with sharp knife, place in pan and allow water from faucet to run over leaves. Remove leaves to another pan and repeat process until no sand accumulates in the bottom of the pan. Cook in covered utensil without extra water. When tender, dress without draining or drain and reserve liquid for soup. Cooked spinach may be chopped before dressing with butter, cream or French dressing or cream sauce.

Note: Other greens may be prepared in the same way, a little water being added with the less tender green. If patient must avoid oxalic acid, spinach should be cooked in plenty of boiling water.

Baked Squash

Procedure: Wash 1 small acorn squash and place in small baking dish. Add water to the depth of ½ inch and bake in a moderately hot oven (400° F.) about 30 minutes (until skin is tender). Remove from oven, cut in half, remove seeds, dot with butter and sprinkle with salt and pepper. Yield: 2 servings.

Baked Tomatoes

Procedure: Wash 1 medium-sized tomato and cut in half. Arrange halves in baking dish and sprinkle with salt, pepper, sugar, minced onion and chopped parsley. Dot with butter or small pieces of bacon and bake in moderate oven (350° F.) about 25 minutes (until tender). Yield: 1 serving.

Broiled Tomatoes

Procedure: Prepare tomatoes according to directions in preceding recipe. After seasoning, cover with soft buttered bread crumbs. Broil about 3 inches from medium heat until crumbs are browned. Yield: 1 serving.

Stewed Tomatoes

Procedure: Wash and peel 2 medium-sized tomatoes, cut in quarters and put in small saucepan. Add 1 slice onion and salt, pepper and sugar to taste. Cook over low heat about 10 minutes and add 1 tablespoon butter. One half cup of croutons (p. 548) may be added just before serving. One cup of canned tomatoes may replace the fresh tomatoes. Yield: 1 serving.

REVIEW QUESTIONS

1. How has the contribution which vegetables make to the diet been recognized? Is the botanical classification an indication of food value?

2. What are the most valuable contributions vegetables make to the diet? List the vegetables in order of ascorbic acid content.

3. Discuss the losses of vitamins from vegetables due to cooking.

4. Compare the nutritive contributions of fresh, canned and frozen vegetables.

5. What care should vegetables be given in the home kitchen? In storage? In preparation for cooking?

6. Give the general rules for cooking vegetables and the reasons for the accepted method.

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Salads and Relishes

Chapter Topics

LEAFY VEGETABLES IN SALADS
OTHER SALAD VEGETABLES
SALAD COMBINATIONS
SALAD DRESSINGS
SALADS AND RELISHES IN THE MENU
PREPARATION OF RELISHES
RECIPES FOR SALADS
RECIPES FOR SALAD DRESSINGS

The term salad now covers innumerable combinations of vegetables, fruits and other food materials which are served crisp and cold with a dressing.

Salads may be divided into two classes. In the first are those which act as appetizers or savories. Except for the dressing served with them, they have little fuel value but are important from the point of view of minerals and vitamins, in which raw fruits and vegetables are particularly high. (See Chaps. 41 and 47.) In the second are those of high nutritive value and protein content from fish, meat, eggs, cheese and nuts which are combined with lighter fruits and vegetables. The latter may be used as the main course for luncheon, but they seldom appear on the dinner table.

A mixed green salad may be served on a chilled plate or in a chilled bowl. Small wooden salad bowls are now obtainable. The dressing may be served in a small pitcher and combined with the salad after the tray has been taken to the patient's room, or the dressing may be mixed with the greens just before the salad is put into the bowl.

Salads made of mixed vegetables and of fruits garnished with salad greens may be served on a salad plate.

Mayonnaise should be placed on top of a mixed vegetable or a fruit salad rather than mixed with it.

The term relish is used to describe raw vegetables such as celery, radishes, carrot strips and others which are served without a dressing. They may replace the salad or they may be served in addition with the soup or with the main course. For the invalid tray, relishes may be arranged on the bread and butter plate.

LEAFY VEGETABLES IN SALADS

The most popular and the most plentiful of the salad plants is lettuce, but there are many other delicious succulent leaves, which, when they can be obtained, may be used to take its place. The quality of lettuce which can be obtained all the year round in almost all sections of the country has improved enormously in the last few years, for its growing popularity has given it a greater market value. Boston and iceberg lettuce, the most plentiful, are different in flavor and in texture, and equally satisfactory to serve as salads. Romaine, escarole, endive of both the curly and the Belgian type, and water cress are other greens which should be considered when they are in the market. The leaves of raw spinach and tender young Swiss chard, sorrel, field grass and dandelion greens are other suggestions. The choice is usually governed by taste and the grades which are available at the time the purchase is made.

It has been the custom to discard the outer green leaves, which are not so tender and crisp as the inner bleached leaves. It has been shown, however, that these green leaves have a higher vitamin content, and where they are in good condition they should be used. Shredded for sandwiches or used as a basis for other ingredients, they are acceptable. Shredded lettuce sandwiches usually prove attractive to children and invalids for luncheon.

To prepare lettuce and other greens for serving, wash the heads, pulling the leaves apart, in several waters; shake off as much water as possible and place in a tightly covered container or a plastic bag, or wrap in a towel or sheet of cellophane or foil. Place in refrigerator in a cold place (but above freezing temperature) and allow to crisp for at least an hour. Greens will keep fresh and in good condition for a number of days under this treatment.

OTHER SALAD VEGETABLES

Cabbage is a favorite ingredient for salad. It is also often used by itself and when mixed with a cooked dressing is known as cole slaw. It may be served on bright green salad leaves or garnished with strips of green pepper or pimiento to add a note of color. To prepare, wash the head, remove outer leaves and immerse the head in cold salted water for a short time. Drain well before shredding. Cabbage should preferably be shredded just before it is to be used.

Cucumbers are used as an ingredient of a mixed green salad or they may be sliced and served with French or sour-cream dressing. Minced onions or chives are generally used in combination with cucumbers. To prepare, wash before placing in refrigerator. If chilled thoroughly, it is not necessary to crisp in salted water after slicing. Cucumbers may be served pared or unpared.

Tomatoes are also used as an ingredient of a mixed salad or they may be served in sliced form with a French dressing. Sometimes the whole tomato, from which some of the pulp has been removed, is stuffed with a mixed vegetable salad. To prepare, wash and place in the refrigerator to chill, or remove skins by plunging into boiling water before chilling in refrigerator. They may be cut in quarters or sliced and marinated in French dressing before being chilled.

Celery in diced form is often used as an ingredient in a salad. Until time to use, the partially trimmed stalks should be kept wrapped or covered in refrigerator.

Carrots are becoming a favorite as an ingredient of a salad. Young carrots, after the removal of part of the tops, should be covered and placed in the refrigerator. They should be scraped and cut just before they are to be used. Carrot strips are often used as a garnish for other salads.

Other Salad Ingredients. Finely cut sticks of yellow or white turnip, cauliflower, green pepper and American artichokes in raw form are sometimes used in mixed salads. Many leftover cooked vegetables such as carrots, string beans, peas or cauliflower may also be used. Cooked spinach mixed with a well-seasoned French dressing may be pressed into small molds, chilled in the refrigerator and served on a bed of salad greens.

Substitutes for Salads. Raw vegetables may be served as relishes rather than in salads. This may be desirable when rich food must be avoided. Tender hearts of celery, crisp radishes and carrot sticks are most commonly used. Flowerets of cauliflower, strips of turnips and young scallions may also be used if allowed.

SALAD COMBINATIONS

The simplest and the best salads which will be most used in the diet of an invalid are the green leaves served with a dressing of some type. Where possible, variations in the kind of leaves served should be made. Romaine, endive of either type, or water cress should appear occasionally on the tray. Cabbage, if finely cut, may also be used and should find favor because it is the cheapest green vegetable during most of the year. A variation in the garnish, a ring of green pepper or pimiento, a brightly colored radish or a piece of beet shaped attractively will suggest variety, even when the basis of the salad is the same.

Fruit Salads. When fruits are used for salad, care should be taken in their combination. Usually salads are

FIG. 116. An attractive fruit salad combination.

more appetizing when few varieties are used in the same combination. Grapefruit and white grapes with a cherry garnish, orange and date, or grapefruit and melon are more attractive both to sight and to taste than a mixture of all of them.

Heavier Salads. When the heavier salads are used as main dishes for lunch or supper, cheese and eggs are often recommended. Meat or fish, mixed with mayonnaise or boiled dressing, makes a combination which may be too rich for some patients. A stuffed egg, a mold of cottage or cream cheese accompanied by a mixed vegetable salad or by the green leaves alone, is usually well liked. A small amount of mayonnaise may be used as a garnish when it is allowed.

Gelatin Salads. Gelatin combined with tomato or fruit juices provides a means of putting extra vegetables and fruits into the diet. Gelatin salads are usually liked and they give variety and attractiveness to the invalid's tray.

SALAD DRESSINGS

French dressing is used more often for invalids than any other kind. This is a simple combination of oil, vinegar or lemon juice and seasonings. Olive oil is considered best for the preparation of dressing, but some people do not care for its flavor. During World War II it was replaced entirely by a salad oil made from corn, cottonseed, peanuts or soy. These oils are generally of bland flavor and have better keeping qualities than olive oil. Care must be taken to keep the oil as nearly airtight as possible and in a cool place. If the bottle is clear glass, keeping it in a dark place is an added precaution against rancidity. Rancid oil served even once by mistake may cause an invalid to refuse to take salad again, and thus make it more difficult to introduce the proper amounts of fruits and vegetables into the diet. After the bottle or can has been used, the top should be wiped carefully.

Oil is also an asset when a diet of high nutritive value is necessary. Mineral oil should not be used in a salad dressing, as it prevents the absorption of vitamin A. Because it has no caloric value, it was often used in the preparation of both French dressing and mayonnaise for the reducing diet. Salad dressing should be savory, but not over-seasoned with condiments, particularly for invalids. If vinegar is forbidden, lemon juice may be substituted for it in most dressings. If oil is forbidden or not liked, lemon juice by itself or mixed with orange juice will give a desirable flavor.

Mayonnaise, an emulsion of oil, egg yolks and acid, should usually be thinned with lemon juice rather than with vinegar. A little catsup or chili sauce added to mayonnaise may be used instead of other seasoning as a variation of Russian dressing for the invalid. It gives color as well as savor to the salad.

Sour-cream Dressing. There is no dressing more useful in the invalid's diet than sour-cream dressing. It is generally liked and can be taken easily in most cases. Sour cream should be purchased as such, as unfavorable bacteria instead of the lactic-acid type may develop in pasteurized cream kept under home conditions. The cream may be whipped and flavored with a few drops of lemon juice or vinegar, as well as salt and paprika.

Boiled Dressing. A cooked dressing often known as a boiled dressing, although it should be made in a double boiler, is particularly appropriate for potato and cabbage salad and may be preferred as a dressing for greens. A cooked dressing with a fruit-juice base is a good choice for use with fruit.

SALADS AND RELISHES IN THE MENU

Through the use of salads and relishes, both the nutritive quality and the attractiveness of the meal can be improved. Salad greens are used either as an ingredient or as a garnish for every type of salad. The use of relishes instead of or in addition to salad is a means of serving vegetables in raw form, in which they contribute practically all their natural vitamin and mineral content.

Through different combinations of fruits and vegetables and through serving them in jellied form with salad greens there can always be variety in both flavor and appearance. If the patient prefers a mixed green salad and welcomes its appearance daily, there is no reason why it should not be served. Different dressings may be served, or the standard French dressing may appear daily, according to the taste of the patient.

The following standards will be helpful in preparing salads. The first three standards apply to relishes also:

1. They should be cold and crisp.
2. They should be attractive to the eye.
3. They should be simple rather than elaborate.
4. They should have a dressing which is well but moderately seasoned.
5. They should be varied either as to combination or to dressing from day to day.

Preparation of Relishes

Celery, radishes and carrot strips are the relishes most used. Scallions, flowerets of raw cauliflower, strips of young turnip and green pepper and thin wedges of cucumber may also be used. The hearts of celery are generally chosen for the invalid's tray, although the outer stalks of the green Pascal celery are tender enough to be acceptable. Cut stalks of celery may be stuffed with a flavored cottage or cream cheese or with a blend of a highly flavored cheese with cream or cottage cheese.

All vegetables should be carefully washed and trimmed. Carrots should be scraped before being sliced into thin strips. Although it is customary to soak these vegetables for half an hour or more in salted water, some of the nutrients may be lost. This will also be the case when they are allowed to stand after they have been prepared. Vegetables to be served as relishes should preferably be prepared just before they are to be used. If it is necessary to prepare them earlier, they should be placed in a covered dish in the refrigerator. As relishes are more appetizing when chilled, there may be a good reason for preparing them an hour or two before serving. A salt shaker on the invalid's tray should accompany relishes.

RECIPES FOR SALADS

Vegetable Salads

Mixed Green Salad

Procedure: Crisp lettuce, romaine or other salad greens may be combined with any raw vegetable such as sliced cucumbers, radishes, sliced onions, shredded carrots, cabbage, green pepper or sliced skinned tomatoes. The ingredients must all be crisp and cold and tossed with French dressing just before they are served. For preparation of cucumbers and tomatoes see cucumber salad and tomato salad (p. 529).

Mixed Vegetable Salad

Procedure: Cooked vegetables such as diced beets, peas, Lima beans and shredded string beans may be combined with a small amount of shredded raw carrots or diced celery and well-seasoned French dressing. Minced onions or chives may be added if desired. Serve in lettuce cup with mayonnaise on the side if desired. Allow ½ cup mixed vegetables for 1 serving.

Potato Salad

Procedure: Mix ½ cup cold diced potatoes with ¼ cup diced celery, 1 teaspoon minced onion and 1 tablespoon French dressing. Just before serving add 1 tablespoon mayonnaise or cooked salad dressing. Serve on lettuce and garnish with minced parsley or green pepper. Yield: 1 serving.

Tomato Salad

Procedure: Scald tomato 1 minute in boiling water. Drench with cold water and drain. Peel and slice or cut into eighths, dress with French dressing. Add sliced onion, diced celery or sliced cucumber if desired. Serve on bed of lettuce with mayonnaise on the side. Yield: 1 serving.

Small skinned tomatoes may be cut in quarters almost to stem end and arranged on lettuce. The tomato cup may be filled with mixed vegetable, chicken or fish salad.

A slice may be removed from the stem end and the center pulp removed, in which case fill center with any fish, meat or vegetable salad. Serve on lettuce and garnish with mayonnaise.

Asparagus Salad

Procedure: Arrange drained and chilled cooked or canned asparagus on bed of lettuce or romaine. Sprinkle with French dressing and garnish with strips of pimiento. Grated cheese may be sprinkled over the asparagus if desired. Allow from 4 to 6 asparagus stalks for 1 serving.

Cabbage Salad

Procedure: Mix shredded cabbage with French dressing, cooked salad dressing, sour cream dressing or mayonnaise. Add minced onion, green pepper or pimiento to the salad, or use as a garnish. Serve in lettuce cup or on other salad greens. Allow 1 cup shredded cabbage for 1 serving.

Cucumber Salad

Procedure: Wash and chill cucumbers. Pare and slice. If cucumbers have not been chilled they may be placed in salted ice water for about 15 minutes after being sliced, and then drained. Dress with French dressing or sour cream dressing; add minced onions, scallions or chives if desired. Allow ¼ cucumber for 1 serving.

Jellied Vegetable Salad

Ingredients:

1 teaspoon granulated gelatin
1 tablespoon cold water
⅓ cup boiling water
2 teaspoons sugar
⅛ teaspoon salt
1 tablespoon lemon juice or mild vinegar
½ cup finely diced celery
2 teaspoons chopped green pepper
2 teaspoons chopped pimiento

Procedure: Soften gelatin in cold water and dissolve in boiling water. Add sugar and salt, stir until dissolved. Chill until mixture begins to thicken. Stir in lemon juice or vinegar and vegetables and pour into 2 small molds. Chill until set. Unmold on salad plate and garnish with lettuce or other salad greens. Serve mayonnaise on the side. Yield: 2 servings.

Note: Shredded cabbage may replace part or all of the celery.

Cheese and Egg Salads

Cottage Cheese Salad

Procedure: Mix ⅓ cup cottage cheese with 1 teaspoon minced onion or chives and 1 teaspoon minced parsley. If dry cheese is used, moisten with cream. Pack in a small buttered custard cup and chill for half an hour. Unmold and serve with water cress or shredded lettuce. Serve with French dressing. Yield: 1 serving.

Cream Cheese Salad

Procedure: Soften cream cheese with fork. Add a small amount of cream if necessary. Form cheese into balls and roll in minced parsley or paprika. Serve on bed of watercress and sprinkle with French dressing. The cheese may be flavored with minced chives or minced onion if desired. Allow from 2 to 3 oz. cheese for 1 serving.

Stuffed Egg Salad

Procedure: Follow directions for stuffed eggs (p. 457). Serve on lettuce and garnish with mayonnaise.

FRUIT SALADS

Apple and Celery Salad

Procedure: Pare, core and dice ½ medium-size apple; combine with an equal amount of diced celery and enough mayonnaise to moisten. Serve in a lettuce cup and garnish with mayonnaise and with 2 or 3 pecan or walnut halves. Yield: 1 serving.

Fresh Fruit Plate

Procedure: Arrange alternately berries in season, sliced pineapple, sliced melon or sections of grapefruit or orange round edge of plate and sprinkle with French dressing. In the center place lettuce cup containing mayonnaise. Cream cheese balls may be used as a garnish. Serve as main luncheon dish.

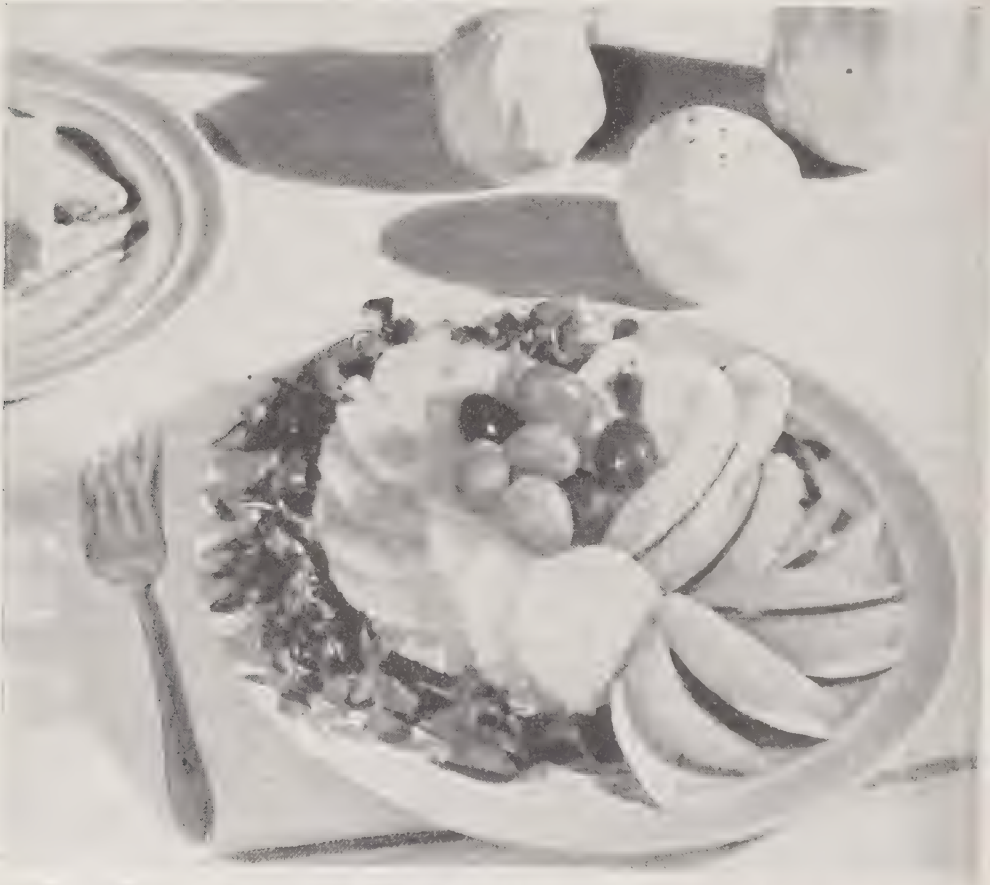

FIG. 117. Fruit salad plate may be a good choice for a luncheon or supper.

Grapefruit and Orange Salad

Procedure: Arrange alternate sections of grapefruit and orange on leaf of lettuce or romaine. Sprinkle with French dressing and garnish with sliced ripe olives or green pepper. Allow 3 sections each of grapefruit and orange for 1 serving. Sliced pared avocado may replace the orange or the grapefruit.

Melon Salad

Procedure: Cut peeled cantaloupe, honeydew or watermelon into balls or cubes. One or all types of melon may be used. Sprinkle with French dressing and chill in refrigerator. Serve on shredded lettuce. Allow from 8 to 10 balls for 1 serving.

Jellied Fruit Salad

Procedure: Follow directions for jellied vegetable salad (p. 529), substituting any combination of diced fresh fruits, with the exception of fresh pineapple, for the celery.

Mixed Fruit Salad

Procedure: Almost any combination of mixed fresh or canned fruits may be used for a mixed fruit salad. Diced apple, fresh pineapple, seeded halved grapes, sections of orange and grapefruit, slices or balls of melon, canned apricots or peaches, pitted sweet cherries and sliced bananas are all used as ingredients for fruit salads. Generally not more than 3 or 4 fruits are combined. The fruit should be chilled and combined just before it is to be served. Arrange fruit on lettuce, sprinkle with French dressing and garnish with mayonnaise or cooked fruit salad dressing. Allow about ¾ cup mixed fruit for 1 serving.

MEAT AND FISH SALADS

Chicken Salad

Procedure: Combine ⅓ cup diced cooked chicken with an equal amount of diced celery. Add 1 tablespoon French dressing and chill half an hour. Serve in lettuce cup and garnish with mayonnaise and stuffed olives or with sliced hard-cooked egg. Leftover cooked pork or veal may replace the chicken. Yield: 1 serving.

Crabmeat Salad

Procedure: Follow preceding directions for chicken salad, substituting flaked fresh or canned crabmeat for chicken. A teaspoon minced onion may be added if desired.

Shrimp Salad

Procedure: Cooked, fresh or canned shrimps may be used. Remove black vein. Arrange on lettuce, sprinkle with French dressing and serve Russian dressing on the side. Allow from 4 to 6 shrimps for 1 serving.

RECIPES FOR SALAD DRESSINGS *

COOKED SALAD DRESSINGS

Cooked Fruit Salad Dressing

Ingredients:

2 egg yolks
¼ cup sugar
¼ cup orange juice
¼ cup pineapple juice
2 tablespoons lemon juice
½ cup whipped cream or sour cream

Procedure: Beat egg yolks in top of double boiler, add sugar and beat until well blended. Stir in fruit juices and cook over hot water, stirring constantly until mixture thickens. Cool and fold in cream. Serve with fruit salad. Yield: About 1½ cups.

Note: Pineapple juice may be replaced by the same amount of orange juice.

Cooked Salad Dressing

Ingredients:

2 teaspoons salt
1 teaspoon dry mustard
4 teaspoons sugar
Dash cayenne
2 tablespoons flour
2 eggs or 4 egg yolks, slightly beaten
1 cup scalded milk
½ cup vinegar

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* Recipes are given in family quantities as they can be stored in refrigerator. They may be halved if desired.

Procedure: Mix dry ingredients in top of a small double boiler. Add slightly beaten eggs or yolks, stir in milk and vinegar. Stir over hot water until mixture thickens. Chill and when ready to serve thin with sour cream. Store in covered jar in refrigerator. Yield: About 1½ cups.

FRENCH DRESSINGS

French Dressing

Ingredients:

- ½ teaspoon salt
- ⅛ teaspoon pepper
- ½ teaspoon sugar
- ½ teaspoon dry mustard
- ½ teaspoon paprika
- ½ cup salad oil
- 2 tablespoons mild vinegar

Procedure: Mix seasonings, add oil and stir until well blended. Add vinegar and beat or shake well until mixture thickens slightly. Store in refrigerator. Beat again just before serving. Onion juice may be added if allowed. Yield: ½ cup.

Chiffonade Dressing

Procedure: Add 1 teaspoon each minced celery, green pepper, raw carrot or stuffed olives to 1 serving (2 tablespoons French dressing). Chopped hard-cooked egg may also be added.

Fruit French Dressing

Ingredients:

- ¼ teaspoon salt
- ½ teaspoon paprika
- ½ teaspoon sugar
- ¼ cup salad oil
- 2 tablespoons orange juice
- 1 teaspoon lemon juice

Procedure: Mix seasonings, add oil and stir until well blended. Add orange and lemon juice and beat thoroughly. Beat or shake just before serving. Yield: About ⅓ cup.

Roquefort Dressing

Procedure: Add crumbled Roquefort cheese to French dressing.

MAYONNAISE

Mayonnaise

Ingredients:

- ½ teaspoon dry mustard
- 1 teaspoon salt
- ½ teaspoon sugar
- 1 egg yolk
- 2 tablespoons lemon juice or vinegar
- 1 cup salad oil

Procedure: Mix mustard, salt and sugar; add egg yolk and mix well. Stir in 1 teaspoon lemon juice or vinegar, add oil gradually drop by drop at first while beating with rotary egg beater. As dressing thickens add lemon juice or vinegar by the teaspoon and continue adding oil until stiff. Keep in covered jar in the refrigerator. Yield: Approximately 1¼ cups.

Note: For fruit salad, fold in just before serving ¼ cup heavy sweet or sour cream, whipped, to an equal amount of mayonnaise.

Russian Dressing

Procedure: Combine mayonnaise with an equal amount of chili sauce. Minced chopped onion and minced chopped green pepper may be added.

OTHER DRESSINGS

Bacon Dressing

Ingredients:

- 1 strip bacon
- 1 teaspoon sugar
- 2 tablespoons vinegar

Procedure: Cut bacon in 1-inch squares and sauté in small frying pan until slightly crisp. Add sugar and vinegar, stir until sugar is dissolved and pour at once over lettuce, shredded cabbage, young spinach leaves or other salad green. Yield: 1 serving.

Sour Cream Dressing

Ingredients:

- 1 teaspoon salt
- ¼ teaspoon paprika
- ¼ cup sour cream

Procedure: Mix seasonings, add cream and beat until well mixed. Sweet cream may be used if ½ tablespoon vinegar is added. One teaspoon minced onion or chives may be added. Yield: About ¼ cup.

REVIEW QUESTIONS

1. Salads as now served may be divided into two classes. What are these classes?
2. Probably the most popular and the most plentiful salad plant is lettuce. Name some other salad plants.
3. It has been the custom to discard the outer green leaves of salad plants. Why should these leaves be used?
4. When fruits are used for salad, care should be taken in their combination. Why?
5. Plan a luncheon with the main dish a salad supplying about one third of the necessary dietary requirements for a day.
6. Plan a lighter luncheon or supper with the main dish a green salad supplying about one fourth of the necessary dietary requirements for a day.

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Soups

Chapter Topics

READY-TO-USE SOUPS
CLEAR SOUPS
UNTHICKENED MILK SOUPS
CREAM SOUPS

Soup, which in the normal diet is often considered an accessory to the meal, may have a more important place in the diet of the ill and the convalescent. A liquid diet will be ordered by the physician for a short or a long period when a patient is unable to handle solid food, or appetite for any type of food may be completely lacking and the patient may be more easily persuaded to take nutritious food in liquid form. A soup made with milk may carry a worthwhile amount of important nutrients. A hot clear soup, while contributing little nutritively, is sometimes "comforting to the stomach" and may serve to stimulate digestive secretion and thereby create a desire for other food. For this reason, a clear soup makes a good beginning for lunch or dinner, even after the patient has begun to take food in meal form. In cases where a high caloric diet is part of the treatment, a cream soup, or at least one made with milk, may be preferred at the beginning of the meal.

READY-TO-USE SOUPS

The nurse, who will have many other duties to perform for her patient besides that of preparing an appetizing tray for each meal, will often take advantage of the variety of canned soups of excellent quality and flavor which are now available. These range from consommé to condensed vegetable soups in good variety. The bouillon cubes and powders with a meatlike flavor and the condensed meat extract may also be useful on occasions when a quickly prepared hot liquid is desirable. Higher in food value are the dehydrated vegetable soups usually made from a pea or a bean base which, when prepared, are rather like a potage, and the combinations of bouillon powder and dehydrated vegetables. These may have a place on the menu when the patient has returned to normal diet.

Both canned and dehydrated vegetable soups may be diluted with milk, both to increase food value and to improve flavor. In the beginning of convalescence, a comparatively large amount of milk should be used when the patient does not care for the normal amount of seasoning. Cream may be used for dilution if it is desirable to increase the calories. Tomato juice, in either cold or heated form, may be used instead of a product labeled soup. A combination of tomato and clam juice may be purchased already mixed, or the products may be bought separately and combined. Chicken consommé may also be combined with either of the above-mentioned products.

CLEAR SOUPS

Clear soups are prepared from both meat and poultry. Directions and recipes for these will be found in Chapter 45 (Meats). Clams furnish the one fish product used for broth which may also be called a clear soup. A combination of chicken stock and clam broth is particularly good.

Clam Broth

Ingredients:

6-10 clams in shell
1 cup water
Dash salt
Paprika

Procedure: Choose chowder clams, if possible, in the shells. Scrub thoroughly with a brush, rinse, place in kettle with cold water, cover and bring to boiling point. Remove clams from broth as soon as shells have opened. The clams may be served at once in the shell or in any other way. Allow broth to settle, strain, reheat,

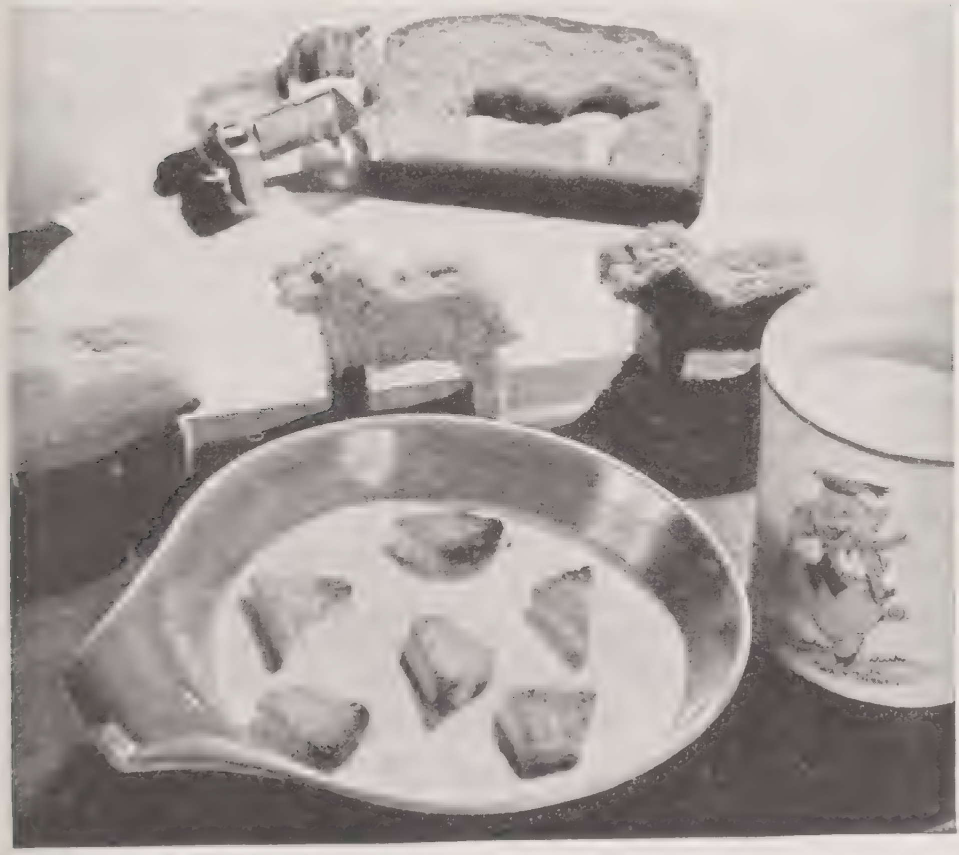

Fig. 11[illegible] An attractive tray for the sick child—soup and sandwiches cut in animal shapes.

add salt and paprika to taste and serve hot. Yield: 1 serving.

Clam broth may be served hot or cold with 1 heaping teaspoon whipped cream, into which a little salt and pepper have been beaten.

Consommé Bellevue

Ingredients:

½ cup chicken stock
½ cup clam broth

Procedure: Thoroughly mix chicken broth with clam broth, heat and serve in bouillon cup. Garnish with 1 tablespoon whipped cream. Yield: 1 serving.

UNTHICKENED MILK SOUPS, CHOWDERS AND STEWS

Basic Recipe for Soups with a Milk Base. Soups with a milk base are used largely in the invalid's diet. Among these an oyster stew is popular. Well-seasoned, finely cut or puréed cooked vegetables may be combined with milk and cream, with milk and chicken or other white stock, without the addition of any thickening. When several vegetables are used, or when fish and vegetables are combined, soups of this type are known as chowders. Unthickened soups may be useful when there is an allergic condition toward wheat.

Celery Soup

Ingredients:

½ cup diced celery
2 slices onion
½ cup water
½ teaspoon salt
½ cup top milk
Dash pepper
1 tablespoon minced parsley

Procedure: Combine celery, onion, water and salt; cover and cook over low heat until celery is tender (about 10 minutes). Scald milk and combine with celery-onion mixture. Add more seasoning if necessary and serve garnished with minced parsley. Yield: 1 serving.

Potato Soup

Ingredients:

1 medium-sized potato
2 slices onion
¼ teaspoon salt
¾ cup milk
1 tablespoon butter
1 tablespoon minced parsley
Dash pepper

Procedure: Pare and dice potato, add enough water to cover, then onion and salt. Cover and cook until potato is tender. Strain and force through a sieve. Heat milk, combine with potato and stir over low heat until very hot. Add butter, parsley and pepper; beat well. If soup is too thick, add more milk and reheat. Also add more salt if necessary. Yield: 1 serving.

Note: For high caloric soup cream may replace milk.

Vegetable Chowder with Milk

Ingredients:

1 tablespoon butter
¾ cup diced vegetables (potato, celery, carrots, peas)
2 slices onion
½ cup water
½ cup top milk
Salt
Pepper

Procedure: Melt butter, add vegetables, cook 2 minutes, stirring constantly. Add water, cover and cook about 10 minutes (until vegetables are tender). Add milk, season to taste with salt and pepper and reheat. Yield: 2 servings.

Oyster Stew

Ingredients:

4-6 oysters
1 tablespoon butter
1 cup milk
¼ teaspoon salt
Dash pepper
Dash paprika

Procedure: Look over oysters to remove any pieces of shell which may be present. Melt butter, add drained oysters and cook 2 minutes until edges curl. Add remaining ingredients and cook over low heat until milk is thoroughly heated. Stir occasionally during cooking. Yield: 1 serving.

CREAM SOUPS

A combination of thin cream sauce with a purée of vegetable or fish, or with a rich stock which is usually chicken or veal, is known as a cream soup or a bisque. If a soup of this type is not thickened, it may "separate," leaving melted fat on the top, which is unattractive. Cream sauce is used to "bind" the materials and to make a smooth, creamy soup. A general rule is to use one half as much vegetable or fish pulp as cream sauce. As it is impossible to make cream sauce in a very small quantity, each of the recipes which follow will furnish one generous serving which may be used to provide a goodly part of the meal, or two servings when soup is to be served as a first course.

The choice of cream soups will often be made when leftover cooked vegetables are on hand. As they will need further cooking to make them soft enough to go through a sieve, the directions which follow for the preparation of vegetable purée may be used for both raw and cooked vegetables. Puréed vegetables may be purchased in canned form. While both vegetables and the cream sauce which forms the base are seasoned, soups should be tasted before they are served and more seasoning should be added, if necessary. If the consistency of the soup is thicker than cream, a little more milk should be added and the soup reheated. For high caloric soup, one half the milk in the recipe for basic cream sauce may be replaced by cream, or extra butter may be added just before serving. With highly flavored vegetables, undiluted evaporated milk or a double amount of powdered milk when reconstituted with water may be used to increase both caloric and protein content.

Purées. Cream soups are sometimes called purées. The fish or vegetables used in their preparation are forced through a very fine sieve in order to produce a particularly smooth soup.

Bisques. The term bisque is generally used for cream soup made from shellfish, or it is sometimes applied to a vegetable cream soup. Sometimes the shellfish are chopped rather than pressed through a purée sieve.

Basic Cream Sauce for Soup

Ingredients:

1 tablespoon butter
1½ teaspoons flour
¼ teaspoon salt
Dash pepper
¾ cup milk

Procedure: Melt butter in small saucepan, stir in flour and seasonings. Stir in milk gradually and continue stirring over low heat until sauce thickens and boils. If there is an allergy toward wheat, 1 teaspoon cornstarch may replace 2 teaspoons flour. Yield: Approximately ¾ cup sauce.

Fresh Vegetable Purée for Cream Soups

Procedure: Allow ¾ cup finely diced vegetables, such as celery, carrots or asparagus, ½ cup diced beets, potatoes, onions, or cut or canned corn, 1 cup fresh or canned peas, 1½ cups spinach or lettuce leaves to flavor one portion of cream soup. Place vegetables in small saucepan, add ½ cup water, ¼ teaspoon salt and a dash sugar. Add 1 or 2 slices onion if allowed. Cover and cook over low heat until vegetables are tender and force through sieve or ricer.

FIG. 119. A milk vegetable soup with parsley garnish.

Canned Vegetable Purée

Procedure: Drain vegetable, combine ¾ cup diced vegetable with ½ cup liquid from can. Follow preceding directions or use canned strained vegetables (baby food).

General Recipe for Cream Soup

Ingredients:

½ cup vegetable purée
¾ cup basic cream sauce
Seasonings

Procedure: Prepare purée. Make cream sauce, add purée and beat well. Add more salt and pepper to taste and other seasonings. Add according to suggestions given below and reheat. Cream soups may be garnished with 1 tablespoon whipped cream sprinkled with paprika. Yield: 1 serving.

Cream of Asparagus Soup

Procedure: Follow general recipe for cream soup. Add a few drops lemon juice and garnish with cooked asparagus tips.

Cream of Beet Soup

Procedure: Follow general recipe for cream soup. The cooked beets may be finely chopped instead of being forced through a sieve, if desired. Flavor with a few drops lemon juice and top with sour cream if desired.

Cream of Carrot Soup

Procedure: Follow general recipe for cream soup. Garnish with parsley.

Cream of Celery Soup

Procedure: Follow general recipe for cream soup. The celery may be finely chopped instead of being forced through a sieve, if desired. Garnish with minced parsley, water cress, chives or grated raw carrot.

Cream of Corn Soup

Procedure: Follow general recipe for cream soup. Use fresh grated corn or canned corn, cream style. To make purée: Use milk instead of water and cook 10 minutes in top of double boiler. The purée may be unstrained if desired. Garnish with strips of pimiento.

Cream of Lettuce Soup

Procedure: Follow general recipe for cream soup. Cook several slices of onion with lettuce. Season with nutmeg and a few drops lemon juice.

Cream of Mixed Vegetable Soup

Procedure: Follow general recipe for cream soup. To make purée: Cooked diced raw vegetables such as potatoes, onions, carrots, celery and any leftover cooked vegetable such as peas, Lima beans, spinach or tomatoes may be cooked together and forced through a sieve. Garnish with minced parsley or grated raw carrot.

Cream of Mushroom Soup

Ingredients:

- 1/2 cup sliced mushrooms
- 1/2 cup water
- 2 tablespoons butter
- 2 teaspoons flour
- 1/4 teaspoon salt
- Dash pepper
- 1/2 cup milk

Procedure: Wash and stem mushrooms. Simmer stems in water until tender. Cut mushroom caps into very small pieces

Fig. 120. Cream soup with star-shaped croutons.

and simmer until tender in 1 tablespoon butter. Melt remaining butter in a small saucepan, stir in flour, salt and pepper, and when well blended stir in stock from stems and milk slowly, stirring constantly over low heat until soup thickens and boils. Add more salt if desired. A teaspoon minced onion may be cooked in the butter with the mushrooms, if desired. Yield: 1 serving.

Cream of Onion Soup

Procedure: Follow general recipe for cream soup. Garnish with minced parsley, grated cheese or minced roasted chestnuts.

Cream of Pea Soup

Procedure: Follow general recipe for cream soup. Add sugar and nutmeg to taste and garnish with paprika or minced cooked bacon.

Cream of Potato Soup

Procedure: Follow general recipe for cream soup. Garnish with minced parsley, chives or water cress.

Cream of Spinach Soup

Procedure: Follow general recipe for cream soup. Add sugar, nutmeg and a few drops lemon juice.

Cream of Tomato Soup

Ingredients:

¾ cup canned tomatoes
½ bay leaf
2 cloves
¼ teaspoon sugar
¼ teaspoon celery salt
1 slice onion
Speck baking soda
Dash pepper
Basic cream sauce (p. 537)

Procedure: Combine tomatoes, bay leaf, spices, seasonings and onion. Bring to boiling point and cook 5 minutes over low heat. Add baking soda and strain into cream sauce. Mix thoroughly and add more salt and pepper to taste. Reheat and garnish with whipped cream. Yield: 1 serving.

Oyster Bisque

Ingredients:

6 oysters
¾ cup milk
½ slice onion
1 sprig parsley
1 tablespoon butter
2 teaspoons flour
¼ teaspoon salt
Pepper

Procedure: Pick over oysters, drain and chop. Combine chopped oysters and drained liquor and bring to boiling. Press oysters and liquor through a sieve. Scald milk with onion and parsley and strain. Melt butter, stir in flour, salt and pepper, and when well blended add strained milk slowly, stirring constantly over low heat until mixture thickens and boils. Add oysters and more salt if necessary. Reheat and garnish with minced parsley or paprika. Yield: 1 serving.

Clam Bisque

Procedure: Follow preceding directions for oyster bisque, substituting clams for oysters.

REVIEW QUESTIONS

1. Why may soup have an important place in the diet of the convalescent? Compare the contributions of a clear and a milk soup.
2. Distinguish between milk soups, chowders and stews.
3. Define a cream soup. What other terms are also used to describe cream soups?
4. Plan a luncheon or a supper using a clear soup and other dishes appropriate for serving with this type of soup.
5. Plan a luncheon or a supper which includes a cream soup.

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Breads, Batters and Doughs

Chapter Topics

- GRAIN FOR BREAD
- COMMERCIAL VERSUS HOMEMADE YEAST BREADS
- YEAST-BREAD STANDARDS
- YEAST IN BREAD-MAKING
- MILK IN BREAD
- RECIPES USING YEAST BREAD AS A FOUNDATION
- QUICK BREADS
- BISCUIT AND MUFFIN RECIPES
- ALLERGY RECIPES
  - BREADS AND MUFFINS
  - CAKES AND COOKIES

Primitive man, perhaps in a lean season when animal food was scarce, added to the wild fruits which were his first source of vegetable food the wild grains which grew on the plain. Soon a primitive mill, made from two stones, ground them. They were then mixed with water and baked between the hot stones which he had learned to use as an oven after the discovery of the use of fire for cooking.

The first use of yeast as a leavening agent was probably accidental. A meal mixture left standing for a period before baking was found to be more palatable, and the story of bread-making—which has been of such importance in the story of mankind—was begun. The ancient Egyptians first developed bread-making in the modern sense. The art spread from them to their neighbors. The children of Israel in their captivity learned their method. Later the Greeks developed a fine bread, and according to history the Roman bakeries of later date were owned by Greeks.

The Romans introduced grains appropriate for bread-making into their colonies and built mills for grinding the flour. The cooks whom they took with them taught the natives their methods of bread-making. During the Dark Ages, when other arts of cookery lapsed, yeast bread remained a staple food. Much of it was very coarse, and even the lord and the lady of the manor had white bread only on special occasions.

After the Renaissance, better grains and methods of milling were introduced. Yeast was the only leavening known until comparatively modern times. The "quick" breads, often known as "hot" breads, are seldom used to any extent in any country except the United States. Corn, or maize, was the only grain indigenous to this country, and it was prepared at first by mixing with water and baking in primitive fashion. Eventually a form of leavening known as pearl-ash, a by-product of wood ashes, came into use. This was followed by commercial baking soda or saleratus, and later by baking powder. It was not until after the invention of the kitchen range a century or so ago that quick breads, in the modern sense, became a factor in the menu.

Although bread is not quite so important a feature of the diet at the present time, when such a variety of foods is available, it remains a staple and is served in some form in most households at all three meals of the day. The yeast loaf is the standard choice.

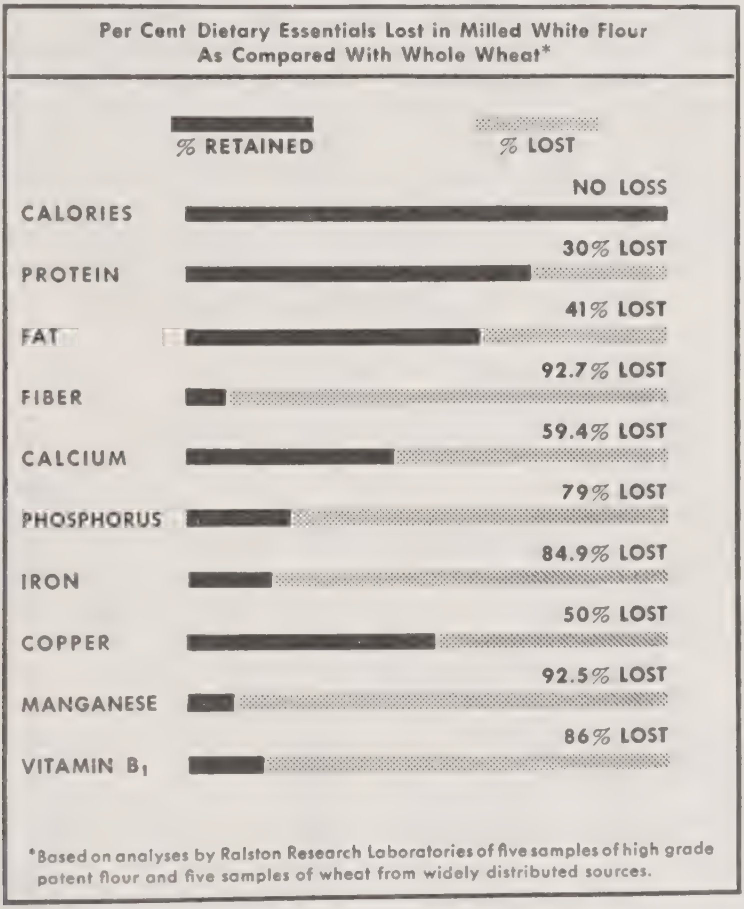
GRAIN FOR BREAD

Various types of ground grain, called flour, are used for bread. The experience of the ages has taught that wheat furnishes the most satisfactory flour for fine-quality bread. In the United States it is the only grain used to any great extent. On account of the large amount of gluten which wheat contains and which "develops" through kneading, wheat is ideal for a yeast bread. It is equally good for the baking-powder breads which are not kneaded. For these reasons wheat is considered the most important of the bread cereals in this country. In some European countries rye and barley are used largely. Rice is not used in bread-making, although it is used to a larger extent than any other grain in the world, as half the world's population use rice as their staple food.

Whole and Milled Grains. In preparing cereals for bread-making the primitive machinery of our early ancestors merely crushed the grain. Later, the coarsest of the bran was removed. The modern roller-milling of wheat is a more complicated and is particularly designed to produce a pure white flour. Such flour contains none of the bran or germ and represents 70 per cent or less of the wheat kernel. The germ and the outer coatings of the wheat which contain most of the minerals and the vitamins are sold mostly for stock feed. A very small proportion of wheat is milled as whole-grain flour or manufactured into whole-grain or "bran" cereals. The taste, the appearance and the keeping quality of white flour and products made from it are largely responsible for the predominating use of white flour in this country.

In an effort to improve the nutritive value of the white loaf, which has become the bread of choice, a program for restoring flour and bread to nearly whole-grain value was initiated during World War II through the concerted efforts of nutritionists and the milling industry. Bread flour and all-purpose flour were enriched according to Federal specifications. Legislation was passed which made it obligatory for all bread made by commercial bakeries to be enriched for the duration of the war. A number of states have already passed laws covering the enrichment of both flour and bread on a permanent basis, and efforts toward the same end are being made by other states. During the shortages of other foods, a larger reliance than usual was put on this staple food. With less than full employment and rising costs of living, enriched flour and bread can make an important contribution to nutrition. Commercial bread may be enriched by the addition of minerals and vitamins or by the use of enriched flour. Study of Figure 121 shows the dietary essentials lost in milling white flour. A study of the chart Comparison of White Enriched and Whole-wheat

Flour shows the great improvement in nutritive value accomplished by the addition of thiamine, riboflavin, niacin and iron to white flour. This enrichment puts it almost on a par as far as these factors are concerned with whole-wheat flour.


Per Cent Dietary Essentials Lost in Milled White Flour As Compared With Whole Wheat*

*Based on analyses by Ralston Research Laboratories of five samples of high grade patent flour and five samples of wheat from widely distributed sources.

Fig. 121. Effect of milling wheat into white flour.

The temporary change in milling which the Federal Government demanded in March, 1946, in order that more flour might be extracted per bushel of wheat to allow of larger shipments of this grain to the starving peoples of the world, increased the vitamin and the iron derived from the natural grain, but not to the level of enrichment. (See Fig. 122, p. 545.)

During the long exposure to heat in the baking process, a small amount of the B vitamin content of both whole-wheat and enriched flour is lost. This is estimated at not more than 10 per cent. However, when bread is toasted, from 12 to 24 per cent of the thiamine may be destroyed.

COMMERCIAL VERSUS HOME-MADE YEAST BREADS

With the perfection of mechanical methods, bread-making has been taken largely out of the home. Bread of good quality can be purchased for little more than the cost of the ingredients and the fuel for baking. In fact, all things considered, the cost of bread made at the bakery is cheaper than that made at home. The usual output of the best bakeries is probably better than the usual homemade breads of a generation ago. Nevertheless, there is something about the flavor and the texture of a loaf of really good homemade bread which compensates for the time and the money expended.

SCORE CARD FOR YEAST BREADS

		Points
GENERAL APPEARANCE		10
Shape—roundness of "dome." Smoothness—no cracks, bulges, lumps or the like. Color of crust—golden brown.		
LIGHTNESS		10
CRUST		10
Thickness. Quality—crispness and tenderness.		
CRUMB		30
Color—light cream color	(5)	
TEXTURE	(25)	
No streaks or extreme closeness of grain. Size and uniformity of cells, thinness of cell walls. Elasticity—softness and springiness.		
FLAVOR—taste and odor		30
Sweet, nutty flavor with no "off" taste.		
KEEPING QUALITIES		10
TOTAL		100

YEAST-BREAD STANDARDS

The United States Department of Agriculture has devised certain standards to which not only the homemade loaf but also the commercial product should conform in most respects. Because of the present custom of wrapping bakery bread, the crust is softer than that of a homemade or unwrapped loaf. There has been a trend toward a softer crumb than that supplied by a homemade loaf. French and Italian bread and other typical foreign breads which have a crisp crust are not wrapped. As these breads generally are made with water rather than with milk, and as no shortening is used, the nutritive contribution may be less than that of the standard loaf. Further, they become stale more quickly. However, they are chosen by some because of their special flavor and crisp crust. During the past few years a number of special breads of close texture, generally high in shortening and sometimes made with honey, have been offered to meet the demand for what is considered a homemade type of loaf. They are sold at a higher price and have a limited but growing distribution. Many of the large commercial bakers offer loaves of rye, gluten, whole-wheat and sometimes cracked-wheat and other types in addition to the standard loaf. As it will seldom be necessary for the nurse to prepare yeast bread for the use of the patient, no recipes are included in the recipe section, except for a wheat-free loaf under Allergy Breads. A standard cookbook may be consulted if there is need for other yeast-bread recipes.

YEAST IN BREAD-MAKING

To raise bread, whether made in the bakery or in the home, compressed yeast is generally used. This is obtainable in cakes, usually mixed with starch. It is sold as moist cakes or as dry cakes or powder. The former is more active, but must be used while fresh, before other micro-organisms develop, as shown by the presence of dark streaks, strong odors, flavors, etc. The latter is less active but keeps longer. For a quick process, the moist fresh yeast cakes are desirable. In whatever form yeast is used, it contains millions of micro-organisms or fungi which reproduce rapidly when given food in the form of sugar (or starch, which is convertible into sugar), a suitable temperature and moisture. The generally available yeasts on the market are pure and

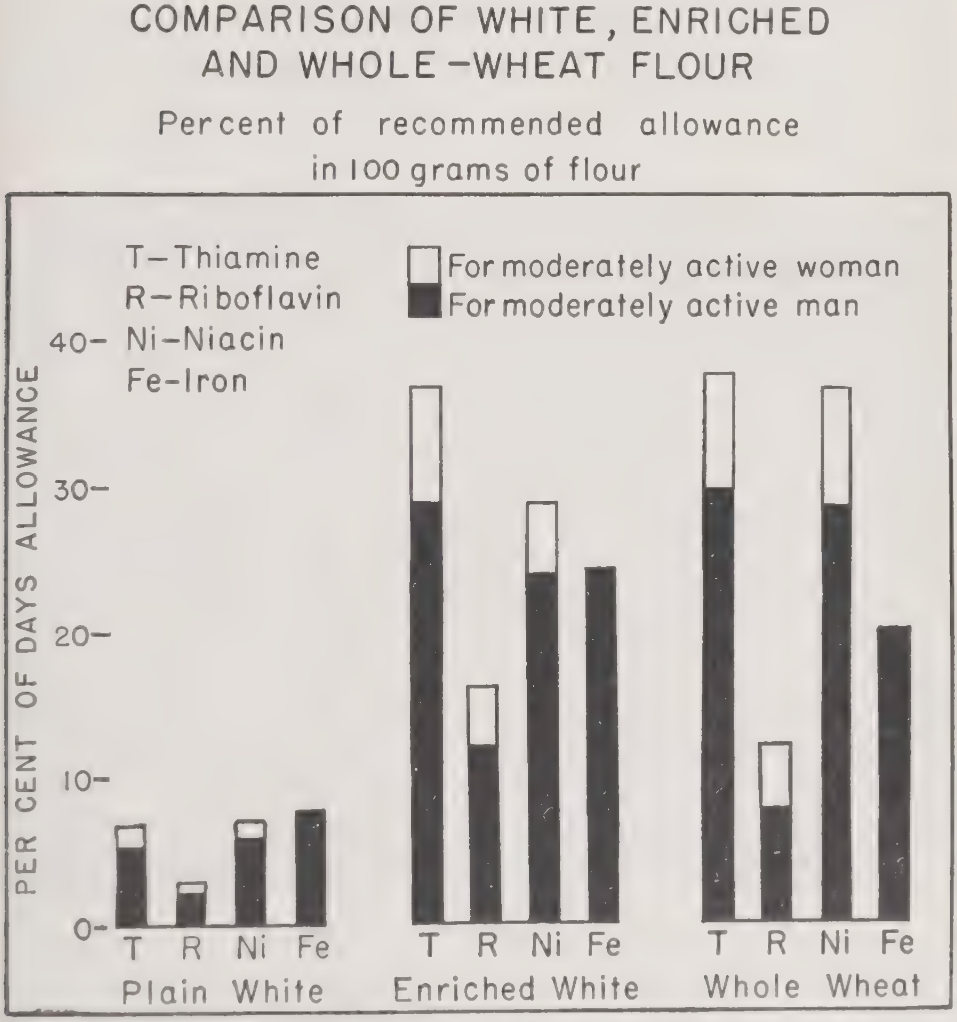


Fig. 122.

begin to act when provided with the above necessities. Much more consistent results are obtainable when the present standardized yeasts are used than when our grandmothers made yeast at home by allowing the wild yeast plants to ferment potato water or flour and water.

Baking. In bread-making, care must be taken to give the yeast plants the proper temperature for action, between 70 and 95° F. A much higher temperature will kill the plants, and a low temperature will retard their growth. Yeasts use ordinary sugars readily, and for this reason a little sugar is added to the sponge. Moisture is furnished by the liquid with which the flour is mixed. A good recipe for bread will cover all these points. When yeast is active, carbon dioxide and alcohol develop in the dough. Carbon dioxide is the gas which raises the bread. The alcohol must be driven out by heat to prevent what is known as the yeasty taste. Bread baked sufficiently at a high enough temperature will be free from this flavor. Recent experimentation has shown that proper baking will dissipate the alcohol, however large an amount of yeast is used. It is thus possible to increase the amount of yeast inversely with the time required for rising and obtain just as good results. The extra cost of the large amount of yeast for quick-process

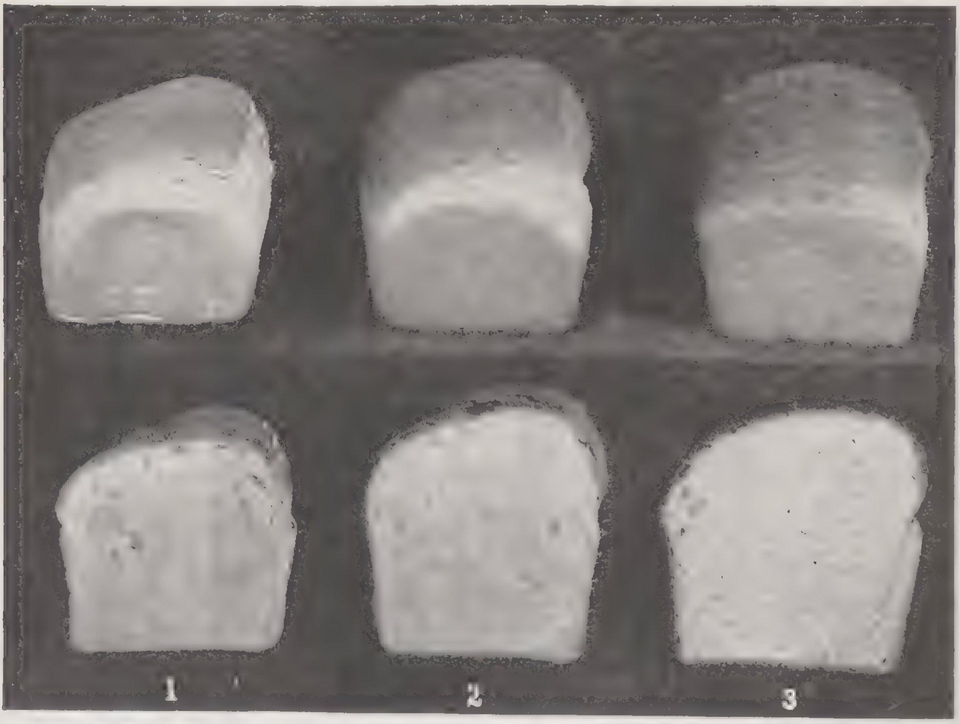


FIG. 123. Loaves of bread showing effect of milk on texture and appearance. Loaf 1 was made with water, loaf 2 with whole skimmed milk, loaf 3 with powdered milk. Note the improvement in the general appearance of the whole loaf and the better texture in 2 and 3. This is due to the use of milk. Milk has the further advantage of increasing the nutritive value of the bread. (University of Illinois.)

bread means a saving of time and therefore may be worth while.

MILK IN BREAD

Bread made with milk has a higher nutritive value than that made with water. Experiments have shown that it is possible to make a loaf of excellent flavor and texture with a large amount of dried milk powder as one constituent. This is now being used commercially to some extent. There is no doubt that nutrition would be improved if commercial breads contained a large amount of milk solids. It is possible to produce a good loaf when dried milk provides 10 per cent of the ingredients.

RECIPES USING YEAST BREAD AS A FOUNDATION

Sliced bread is often used for toast and may be thick or thin according to preference. For Melba toast, thinly sliced bread must be used. For croutons, either thick or thin bread may be used. For sandwiches of the luncheon or picnic type, thick slices are usually preferred, while for tea sandwiches the thinner slices are desirable. Bread crumbs, both soft and dry, are used as a topping or a coating for other foods. They are also used to make a stuffing for fowl and other meats.

Toast Recipes

Toast

Procedure: For toast which is to be served as an accompaniment at breakfast or another meal, bread should be in slices from ¼ to ½ inch thick, depending upon the preference of the patient. The crusts may be trimmed if desired before toasting in the broiling oven of the gas or electric stove, or in the electric toaster. The last may be used in the patient's room. Bread should be toasted on both sides until golden brown, and unless dry toast is preferred by the patient or ordered by the doctor, it should be buttered as soon as it is made. Buttered toast should never be put under the heat of the broiler. If it cannot be served immediately, it may be kept warm by the retained heat of the broiling oven after the heat has been turned off. Toast made in the kitchen should be wrapped in a napkin to keep it as hot as possible.

Melba toast is made from thinly sliced bread and should be baked in a very slow oven (250° F.) until golden brown. It may be served hot or cold, and is often ordered for the invalid diet.

Milk Toast

Ingredients:

1 cup milk
⅛ teaspoon salt
2 slices buttered toast

Procedure: Heat milk in double boiler, add salt. Serve in heated pitcher with toast arranged in a hot cereal bowl. Pour milk over 1 slice of toast at a time when serving. Cream may be substituted for half the milk. Yield: 1 serving.

Cream Toast

Ingredients:

1 tablespoon butter
1 tablespoon flour
½ teaspoon salt
1 cup milk
2 slices buttered toast

Procedure: Melt butter in a small saucepan, stir in flour and salt, stir in milk gradually and continue stirring over low heat until sauce thickens and boils. Pour at once over buttered toast. Garnish with minced parsley or paprika. Yield: 1 serving.

Cheese Toast

Procedure: Follow preceding directions for cream toast. After sauce has thickened, add ¼ cup grated cheese, stir until melted and pour over toast.

Cream Tomato Toast

Procedure: Follow directions for cream toast (p. 547), substituting ¼ cup strained cooked tomatoes for ¼ cup milk. If seasonings are allowed, cook 1 slice onion, 1 bay leaf and 2 cloves with the tomatoes. Pour over buttered toast.

Cinnamon Toast

Procedure: Sprinkle hot buttered toast with mixed sugar and cinnamon. Allow ⅛ teaspoon cinnamon and 1 tablespoon sugar for each slice of toast.

Special Cinnamon Toast

Ingredients:

2 slices bread
1 tablespoon butter
2 tablespoons sugar
¼ teaspoon cinnamon

Procedure: Trim crust from sliced bread; cream butter, sugar and cinnamon. Spread on bread and cut in finger lengths. Bake in moderate oven (350° F.) from 10 to 12 minutes (until slightly brown). Yield: 1 serving.

Croutons

Procedure: Remove crusts evenly with a long, sharp knife from sliced bread; reserve crusts for dry crumbs. Cut bread into cubes or fancy shapes and bake in a moderate oven (325° F.) or brown lightly in butter in a small frying pan. Stir occasionally with either method.

Croustades

Procedure: Cut a slice of bread 2 x 3 inches from loaf. Trim crust evenly and remove enough crumb from center to form a box. Brush with melted butter and bake in moderately hot oven (400° F.) until brown and crisp.

Toast Water

Ingredients:

3 slices Melba toast
1 cup boiling water
Salt

Procedure: Break toast into small pieces and pour boiling water over it. Let stand for 1 hour, strain, add salt and serve hot or cold. If desired, a teaspoon of wine or cream and sugar to taste may be added. Toast water is usually given, however, to postoperative or very sick patients who can take only the slightest amount of nutriment, and it is therefore usually served plain. Yield: 1 serving.

Toasted crackers may be used in place of Melba toast.

PREPARATION OF CRUMBS

Fine Dry Crumbs

Procedure: Dry crusts or bread slices in slow oven until crisp enough to roll. Place on towel, fold over and crush with rolling pin.

Soft Crumbs

Procedure: Use bread one day old or more, but not dried out. Rub slices together or grate, discarding crusts. Three slices of bread ½ inch thick will make about 1 cup crumbs.

SANDWICHES

GENERAL DIRECTIONS FOR MAKING SANDWICHES

When a sandwich is to serve as the main luncheon dish, sliced bread or bread cut ½ inch thick may be used. For dainty sandwiches to serve with salads or with tea, thinly sliced bread should be used. Canapés, which are merely open sandwiches, usually garnished attractively, may replace the thin filled sandwiches. If loaf bread is used, a long thin knife, preferably with a saw edge, should be chosen and kept absolutely vertical while the loaf is cut, in order that slices may be of even thickness. Bread a day old will slice more easily than fresh bread. Unless sandwiches are to be toasted, the bread should not be purchased more than a day ahead. Butter should be allowed to soften at room temperature, but should not be melted. If not quite soft enough to spread, it may be worked with a stiff knife with a rounded end until the desired consistency is reached.

For the invalid's tray, the crusts are usually removed from the bread for luncheon, supper and tea sandwiches. This should be done evenly with a comparatively long sharp knife, and it is easier to do after the sandwiches are filled. For this reason, filling should not go completely to the edge; this avoids waste. If the patient likes crusts, they should be left on the bread. Bread is often toasted, sometimes on both sides and sometimes on one side, for luncheon or supper sandwiches before they are filled. Dainty sandwiches may be toasted after filling.

When chicken, fish, cheese or peanut butter is used as the main ingredient of the filling, sandwiches may sometimes serve as meat alternates, and even the dainty sandwiches may be counted upon to add somewhat to the protein content of the diet. When salad greens are included with the sandwich filling, they should be crisp, and if shredded they are easier to eat. Luncheon or supper sandwiches should be cut into strips, either lengthwise or diagonally, unless they are to be served "open face," when they will be eaten with a fork. For these, spreads contrasting in flavor and in color may be used. Well-seasoned cottage cheese, for instance, may be

Fig. 124. Open-face sandwiches, cottage cheese, bacon and tomato.

spread on one slice of bread or toast, while bacon and tomatoes may be used on the other.

LUNCHEON OR SUPPER SANDWICHES

Chicken or Turkey Sandwiches

Procedure: Thinly sliced chicken or turkey between slices of buttered bread is often preferred to a chopped filling for a luncheon or a supper sandwich. This may be seasoned merely with salt and pepper. Crisp lettuce may be placed on top of the meat and spread with mayonnaise.

Procedure: Chopped chicken or turkey may be mixed with mayonnaise and seasoned with a small amount of onion if allowed and liked. For a salad sandwich, the meat should be chopped coarsely and combined with celery as well as mayonnaise. For a minced chicken or turkey sandwich, the meat may be finely ground or chopped, or a chicken or turkey paste may be used.

Meat Sandwiches

Procedure: Use directions for chicken or turkey sandwiches. Chili sauce or catsup may replace the mayonnaise.

Fish Sandwiches

Procedure: Cooked or canned salmon, tuna fish, lobster, crabmeat or flaked shrimp may be used. For 1 sandwich allow ⅓ cup fish, 2 tablespoons minced celery and mayonnaise to moisten.

Cream or Cottage Cheese Sandwiches

Procedure: As filling for a luncheon sandwich, use ½ cake cream cheese or ¼ cup cottage cheese. Add sweet or sour cream if necessary to soften enough to spread. Minced olives, chopped nuts, chives or minced onion and parsley may be mixed with the cheese.

Peanut Butter Sandwich

Procedure: For one sandwich, use from 2 to 3 tablespoons peanut butter. If too thick to spread, moisten with cream or milk or with chili sauce or catsup, which will add flavor. Serve between slices of buttered bread, or bread toasted on one side only. If desired, toasting may be done after sandwich has been filled. A tart jelly may be spread on top of the peanut butter if desired.

Peanut Butter and Bacon Sandwich

Procedure: Mix 2 tablespoons peanut butter with 1 tablespoon cream or chili sauce. Mince 1 strip cooked bacon and mix with peanut butter. Spread on 1 slice hot buttered toast or on 2 buttered halves of finger roll. The latter may be put under the broiler for 2 minutes if desired.

Salad Sandwich Roll

Procedure: Split a soft finger roll and spread with softened butter. Pile chicken, crab or shrimp salad on each half. Garnish with strips of green pepper or pimiento, or with hard-cooked egg yolk which has been put through a sieve. One half of the roll may be piled with chicken or fish salad and the other half with creamed butter mixed with deviled ham or anchovy paste.

Bacon and Tomato Sandwich

Procedure: Toast 2 slices bread and trim crusts. Put 1 slice on warm plate, cover with crisp lettuce and thick slices of skinned tomatoes. Arrange crisp bacon on top of tomatoes and cover with other slice of toast. Cut diagonally into 3 sections. The tomatoes may be spread with mayonnaise if desired.

Cheese Dream

Procedure: Toast 1 slice bread on one side. Trim crust and butter untoasted side. On this arrange thin slices of American cheese. Sprinkle with paprika and spread with prepared mustard if desired. Place under broiler about 3 inches from heat and toast until cheese melts. Minced uncooked bacon or 2 strips of bacon may be placed on top of cheese before it is toasted. Serve with sliced skinned tomatoes if desired.

Club Sandwich

Procedure: Toast 3 slices of bread lightly, trim edges evenly with long sharp knife and spread with butter. On the first slice arrange leaves of crisp lettuce and slices of cooked chicken. Spread with mayonnaise and cover with second piece of toast. On this arrange sliced tomatoes. Spread tomatoes with mayonnaise and top with broiled bacon. Cover with third slice of toast and cut diagonally into 3 sections. Garnish with lettuce and stuffed olives.

Grilled Sardine Sandwich

Procedure: Toast 1 slice bread on one side and trim crust. Arrange drained sardines on untoasted side, place under broiler about 3 inches from heat and toast about 3 minutes until sardines are thoroughly heated. Place on warm plate and sprinkle with lemon juice or serve with a lemon quarter.

Hot Mushroom Sandwich

Procedure: Use 2 slices buttered bread or 2 slices buttered toast. Trim crusts. Put 1 slice bread or toast on warm plate and cover with creamed mushrooms (p. 522). Cover with other slice and garnish with parsley or with sliced hard-cooked egg.

TEA SANDWICHES

Softened butter, cream cheese or a meat paste is generally the basis of filling for dainty sandwiches. The thinly sliced bread may be spread with softened butter or with cheese. The butter and the cream cheese may be flavored with minced water cress plus a little lemon juice and onion juice, if allowed. Anchovy paste may also be used as a flavoring. Cream cheese may be thinned with sweet or sour cream and flavored with minced olives or chopped nuts. The meat paste should be thinned with sweet or sour cream and may be seasoned to taste. The spread slices of bread may be covered with unspread slices if desired and cut with a sharp knife into squares or diamonds or with a fancy cutter. Open sandwiches, or canapés as they are called, may be garnished with sliced hard-cooked eggs, sliced olives or strips of pimiento or green pepper, if allowed. The spread slices, after the crusts have been trimmed evenly, may be rolled and then fastened with a toothpick and garnished at the end with sprigs of parsley or water cress.

QUICK BREADS

The leavening or the raising of dough can be produced by the combination of an acid with an alkali, sodium bicarbonate or baking soda. This action is quite fast, and for that reason is used in the preparation of doughs and batters for quick breads such as muffins, griddle cakes, biscuits, cakes and cookies. Molasses and soda or sour milk and soda are used for certain products, but baking powder is more widely used.

The acid-reacting materials used in baking powders are: (1) Tartaric acid and its salt, commonly known as cream of tartar. Such powders are classified as tartrate powders. (2) Acid salts of phosphoric acid which give the powders the name of phosphate. (3) Compounds of aluminum. The aluminum compound used at present is sodium aluminum sulfate. The manufacturers have designated this powder by the initials of the acid salt S. A. S. (4) Combinations of any of the above acid ingredients. The combination most frequently used is that of (2) and (3). This combination powder is frequently designated as S. A. S. phosphate. The aluminum salt is more frequently used in combination than alone.

The chief difference between these powders is the reaction time in the cold. The tartrate powders react very quickly with the production of the carbon dioxide gas. Therefore the mixtures containing them should not be beaten after the ingredients are thoroughly mixed, since the beating tends to drive out the gas. This is especially true of thin mixtures.

The aluminum salt S. A. S. is relatively insoluble in the cold dough or batter and requires heat to produce complete action. Mixtures containing this type of powder may well be beaten longer than when tartrate powders are used, and if it is desirable they may be allowed to stand from 10 to 15 minutes at room temperature before baking. The phosphate is more soluble than the aluminum salt, but less soluble than the tartrate. It is intermediate in its reaction time.

There was at one time much discussion in regard to the wholesomeness of various baking powders, especially those containing aluminum compounds. Well-known scientists differed in opinion as to the effect of the residue from aluminum compounds upon health. Later research work with this type of baking powder, however, has resulted in confirmation of the theory that aluminum salts in the quantities in which they are usually found in breadstuffs are harmless. As baking powders of this type are inexpensive, they are used largely today. When a combination powder replaces a baking powder of another type in a recipe, about one third less should be used.

Baking-powder mixtures will in any case figure only slightly in the diet of the invalid. Bran, whole-wheat and gluten muffins are the only baking-powder breads used to any extent. When baking-powder mixtures are used, they should be baked thoroughly.

FIG. 125. Mixing bran muffins.

Other Methods of Raising Batters. The raising of batter may be done by air and steam. Sponge cakes and angel cakes, which contain no chemical leavening agents, are raised by the expansion of the air beaten into the thin batter, and also by the steam generated from the heating of the water in the mixture. Steam plays the principal part in raising preparations which are made from thin batter—so thin that it allows the force of the steam to raise it.

Doughs and Batters. A mixture of flour and other ingredients combined with just enough liquid so that the dough may be rolled is known as a dough, while a thinner mixture is known as a batter. The latter usually contains eggs. Biscuits, cookies and pastry are examples of doughs; griddle cakes, muffins, popovers and waffles are examples of batters. All-purpose flour is the choice for doughs and for all batters excepting fine cake, for which a highly refined cake flour is preferable.

To obtain a tender texture, both doughs and batters should be handled as little as possible. Doughs should be rolled only enough to produce the proper thickness; batter should be stirred just enough to moisten the dry ingredients thoroughly.

Recipes for biscuits and muffins of the standard type follow. Additional recipes for breads, biscuits and muffins, and for cookies and cakes will be found under "Allergy Recipes," also in this chapter.

BISCUIT AND MUFFIN RECIPES

Biscuits and muffins, often known as quick breads, are easy to prepare. Because of the comparatively small amount of shortening used in their preparation, both dough and batter must be handled gently if the products are to be tender. When liquid is added to the dry ingredients, there should be no overstirring or beating. Muffin batter need not be free from lumps to produce a standard product that is light with a fluffy tender crumb free from large holes. Biscuit dough should be kneaded lightly just long enough to smooth it in order to obtain a light, tender product.

Both biscuits and muffins should be served as soon as possible after they come from the oven and should be arranged in a napkin for serving. Leftover products may be reheated in a roll warmer in the oven, if they are covered, or they may be split and toasted.

Baking Powder Biscuits

Ingredients:

1 cup sifted flour
1½ teaspoons baking powder
¼ teaspoon salt
2 tablespoons shortening
⅓ cup milk (about)

Procedure: Mix and sift the dry ingredients together. Work in the shortening with tips of fingers or cut in with 2 knives. Add the liquid all at once, mixing with a knife gently until flour is dampened. Then stir quickly just until dough follows knife round bowl (about 30 strokes altogether). Pat or roll to ½ inch in thickness. Cut into rounds with a biscuit cutter. Press trimmings together lightly, pat or roll and cut into rounds. Place on ungreased baking sheet and bake in a hot oven (450° F.) from 12 to 15 minutes. Yield: 8 biscuits.

Drop Biscuits

Procedure: Follow directions for baking powder biscuits. Increase milk to ½ cup and omit kneading. Drop by tablespoonfuls on ungreased baking sheet.

Muffins

Family-size recipes for muffins demand only one egg. For this reason and because a large number of muffins may be baked as easily as a small number, it is well to prepare large recipes if the other members of the family besides the patient like hot breads. For a small recipe, beat egg before dividing into equal halves. The remaining half may be used for some other purpose in cooking. Both family-size and small-quantity recipes are given for muffins.

Plain Muffins

Family Size

Ingredients:

2 cups sifted flour
3 teaspoons baking powder
2 tablespoons sugar
½ teaspoon salt
1 egg
2 tablespoons melted shortening
1 cup milk
Yield: 16 small muffins

Small Quantity

Ingredients:

1 cup sifted flour
1½ teaspoons baking powder
1 tablespoon sugar
¼ teaspoon salt
½ egg
1 tablespoon melted shortening
½ cup milk
Yield: 8 small muffins

Procedure: Mix and sift the dry ingredients. Beat egg thoroughly and stir in melted shortening. Add milk and stir well. Stir this mixture all at once into the dry ingredients until they are just moist (about 15 strokes). Drop into greased muffin pans and bake in hot oven (425° F.) about 20 minutes if small muffin pans are used, from 25 to 30 minutes if large pans are used.

Corn-meal Muffins

Procedure: Follow directions for plain muffins below. For Family-Size Recipe: Combine 1 cup sifted white flour with ¾ cup corn meal. For Small-Quantity Recipe: Combine ½ cup sifted white flour with ⅜ cup corn meal.

Whole-wheat Muffins

Procedure: Follow preceding directions for plain muffins. For Family Size: Combine 1 cup sifted white flour with the other dry ingredients and sift together. Add ¾ cup unsifted whole-wheat flour to this mixture.

For Small Quantity: Combine ½ cup sifted white flour with the other dry ingredients and sift together. Add ⅜ cup unsifted whole-wheat flour to this mixture.

Rich Muffins

Family Size

Ingredients:

2 cups sifted flour
3 teaspoons baking powder
½ teaspoon salt
¼ cup shortening
¼ cup sugar
1 egg
1 cup milk
Yield: 16 small muffins

Small Quantity

Ingredients:

1 cup sifted flour
1½ teaspoons baking powder
¼ teaspoon salt
2 tablespoons shortening
2 tablespoons sugar
½ egg
½ cup milk
Yield: 8 small muffins

Procedure: Mix and sift dry ingredients. Cream shortening, add sugar and cream until fluffy. Stir in egg. Add dry ingredients alternately with milk, beating well after each addition. Bake in greased muffin pans in moderately hot oven (425° F.) from about 20 to 30 minutes.

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Procedure: Follow preceding directions for rich muffins. Pour batter into a greased cake pan 8 inches square. Sprinkle with ¼ cup sugar mixed with 1 teaspoon cinnamon. Bake in a moderate oven (375° F.) 30 minutes.

Bran Muffins

Family Size

Ingredients:

2 tablespoons shortening
¼ cup sugar
1 egg
1 cup bran
¾ cup milk
1 cup sifted flour
2½ teaspoons baking powder
½ teaspoon salt
Yield: 16 muffins

Small Quantity

Ingredients:

1 tablespoon shortening
2 tablespoons sugar
½ egg
½ cup bran
⅜ cup milk
½ cup sifted flour
1¼ teaspoons baking powder
¼ teaspoon salt
Yield: 8 muffins

Procedure: Cream shortening and sugar thoroughly. Add unbeaten egg and beat well. Stir in bran and milk. Let soak until most of moisture is taken up. Add sifted dry ingredients and stir only until flour disappears. Bake in greased muffin pans in moderately hot oven (400° F.) about 30 minutes.

ALLERGY RECIPES

The most common food allergies are toward milk, wheat and eggs, and to provide breads free from these products often presents a problem. The crisp rye wafers which can be purchased are free from all these offending substances, but the patient may tire of them. When the allergy is toward milk alone, any standard recipe may be used by merely substituting water for milk. When the patient is allergic only to wheat, the following substitutions can be made in standard recipes:

COMBINATIONS OF FLOUR TO BE USED IN PLACE OF 1 CUP WHEAT FLOUR

(1)	Rye flour	½ cup
	Potato flour	½ cup
(2)	Rye flour	⅔ cup
	Potato flour	⅓ cup
(3)	Rice flour.... (10 tablespoons)	⅝ cup
	Rye flour	⅓ cup
(4)	Soy flour	1 cup
	Potato starch flour	¾ cup

When substitutes for wheat flour are used, the resulting products cannot be scored by the standards used for breads made with wheat flour alone, especially when eggs must be omitted. It is sometimes difficult to purchase flours other than wheat, and usually a "health store" is the only place where they can be got. It may be more practical to purchase a "mix" designed for the allergic person than to combine the desired flours. If possible, light-rye rather than whole-rye flour should be chosen, as the whole-rye flour spoils rather quickly. Corn meal and ground rolled oats are two products which can be used to advantage, as they are always available and are generally acceptable.

When small quantities of various flours are to be combined and when coarse flours are used, it is not necessary to sift the flour before measuring, but combinations of flours should be thoroughly mixed and sifted with the other dry ingredients. Most muffins and biscuits have better texture when made in small sizes. If small muffin

Fig. 126. Bran muffins ready for serving.

pans and biscuit cutters are not available, decrease the indicated oven temperatures by 25 degrees and increase the baking time slightly for larger products. For further information with regard to recipes for the allergic patient the nurse is referred to "Revision of Allergy Recipes" prepared by the Diet Therapy Section of the American Dietetic Association.

Breads and Muffins

In the following recipes the letters W-E-M denote the absence of wheat, eggs and milk, according to the initial or initials used.

Rye Bread (W-E-M)

Ingredients:

1 cake compressed yeast or 1 envelope quick-rising dry yeast
1⅓ cups lukewarm water
2 tablespoons sugar
1½ teaspoons salt
2 tablespoons melted shortening
5 cups light rye flour (approximately)

Procedure: Crumble compressed yeast or empty envelope of dry yeast into large bowl. Add ⅓ cup of the lukewarm water and 1 teaspoon sugar. Stir and let stand 5 minutes. Add remaining sugar, salt and shortening. Stir until well mixed. Stir in half the flour and beat until smooth. Sprinkle about ½ cup of remaining flour on kneading board. Add remainder to mixture, and when well blended turn out on floured board. Knead until smooth and elastic. Place in greased bowl, cover with a towel and let rise over hot water until double in bulk. Divide into two parts and shape each on floured board, kneading until mixture can be shaped into a loaf. Place in greased bread pan and let rise until double. Bake in a moderately hot oven (425° F.) until lightly browned (about 15 minutes). Lower temperature to 350° F. and continue baking about 30 minutes more.

Steamed Rye Bread (W-E-M)

Ingredients:

¾ cup rye flour
¾ cup corn meal
½ teaspoon baking soda
1 teaspoon salt
¾ cup ground rolled oats
½ cup molasses
¾ cup water

Procedure: Mix and sift together rye flour, corn meal, soda and salt. Stir in the ground rolled oats. Add molasses and water all at once and stir until well blended. Pour mixture into two greased quart molds or cans. Cover tightly and steam 3 hours. Uncover, place in slow oven (350° F.) for about 20 minutes, until tops of loaves are dry. The loaves not used at once may be wrapped in waxed paper for storing and then resteamed in the molds until hot. Yield: 2 loaves.

Banana Rye Bread (W-E-M)

Ingredients:

2 cakes compressed yeast
3 tablespoons lukewarm water
1 tablespoon salt
1½ tablespoons sugar
3 tablespoons melted shortening
2¼ cups mashed ripe bananas[1] (5 to 6 bananas)
5¼ to 6 cups light rye flour

Procedure: Dissolve yeast in water. Mix together salt, sugar, shortening and bananas. Add half the flour and beat until smooth. Beat in the dissolved yeast. Add remaining flour gradually and mix well. Turn dough out onto a floured board. Knead about 8 minutes, adding just enough additional rye flour to prevent sticking. Place dough into a lightly greased bowl. Cover and let rise until double in bulk (about 2 hours). Turn out again onto floured board and knead lightly about 2 minutes. Shape dough into 2 loaves. Place into lightly greased bread pans (8 x 4 x 3 inches). Cover and let rise again until double in bulk (about 1 hour). Bake in a moderately hot oven (425° F.) from 5 to 10 minutes, or until crust begins to brown. Reduce temperature to 350° F. and bake from 35 to 40 minutes longer, or until bread is done. Remove from pans. Brush top crusts with water. Yield: 2 loaves.

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[1] Use fully ripe bananas—yellow peel flecked with brown.

Rolled Oats Biscuits (W-E-M)

Ingredients:

2 cups finely ground rolled oats
1 teaspoon salt
3 teaspoons baking powder
3 tablespoons shortening
⅜ to ½ cup water

Procedure: Mix ground oats thoroughly with salt and baking powder. Cut in or rub in shortening until mixture is as fine as coarse corn meal. Stir in enough water to make a stiff dough. Pat out and cut into rounds. For a drop biscuit, add more water and drop by tablespoonfuls on baking sheet. Bake in hot oven (450° F.) from 10 to 12 minutes. Yield: 12 small biscuits.

Note: I cup light-rye flour may replace 1 cup ground rolled oats.

Corn and Rice Muffins (W-E-M)

Ingredients:

½ cup rice flour
½ cup corn meal
½ teaspoon salt
2 teaspoons baking powder
2 tablespoons sugar
½ cup water
2 tablespoons melted shortening

Procedure: Mix and sift the dry ingredients. Stir in water and the melted shortening; beat until very well blended. Bake in small greased muffin pans in moderately hot oven (400° F.) from 20 to 25 minutes. Yield: 6 small muffins.

Rice and Soy Muffins (W-E-M)

Ingredients:

1 cup rice flour
½ cup soy flour
½ teaspoon salt
3 teaspoons baking powder
1 tablespoon sugar
¾ cup water
2 tablespoons melted shortening

Procedure: Mix and sift dry ingredients three times. Stir in water and the melted shortening; beat until very well blended. Bake in small greased muffin pans in moderately hot oven (400° F.) from 20 to 25 minutes. Yield: 8 small muffins.

Rye and Corn-meal Muffins (W-E-M)

Ingredients:

½ cup light-rye flour
½ cup corn meal
3 teaspoons baking powder
1 tablespoon sugar
½ teaspoon salt
½ cup water
1 tablespoon melted shortening

Procedure: Sift dry ingredients together. Stir in water and shortening; continue stirring until blended. Bake in well-greased muffin tins in moderately hot oven (400° F.) from 20 to 25 minutes. Yield: 6 small muffins.

Buckwheat and Rye Muffins (W-E-M)

Ingredients:

¼ cup buckwheat flour
¾ cup light-rye flour
2 teaspoons baking powder
½ teaspoon salt
1 tablespoon sugar
¾ cup hot water
1 tablespoon shortening
2 tablespoons molasses
¼ teaspoon soda

Procedure: Mix and sift flour, baking powder, salt and sugar. Combine hot water, shortening and molasses. Add soda, stir until dissolved and stir into the flour mixture. Bake in small well-greased muffin pans in moderately hot oven (400° F.) from 20 to 25 minutes. Yield: 8 small muffins.

Note: This makes a muffin of cakelike texture.

Soy and Potato Muffins (W-E-M)

Ingredients:

- ½ cup soy flour
- ½ cup fine potato flour
- ½ teaspoon salt
- 1 tablespoon sugar
- 3 teaspoons baking powder
- ½ cup water
- 3 tablespoons melted shortening

Procedure: Mix and sift the dry ingredients three times. Stir in water and melted shortening; beat until well blended. Bake in small well-greased muffin pans in moderately hot oven (400° F.) about 25 minutes. Yield: 6 small muffins.

Old-fashioned Johnnycakes (W-E-M)

Ingredients:

- 2 tablespoons shortening
- 1 cup boiling water
- 1 cup corn meal
- ½ teaspoon salt
- 2 tablespoons sugar

Procedure: Add shortening to boiling water. Stir in corn meal, salt and sugar, and stir over low heat until mixture thickens. Drop by tablespoonfuls on preheated well-greased griddle and bake until lightly browned on both sides. Lower heat under griddle and bake 5 minutes more, turning often. Yield: 10-12 cakes.

Corn and Oat Muffins (W-M)

Ingredients:

- ¾ cup corn meal
- 1 teaspoon salt
- 3 teaspoons baking powder
- 3 tablespoons sugar
- 1 cup finely ground rolled oats
- ¾ cup water
- 1 tablespoon melted shortening
- 1 egg, well beaten

Procedure: Mix and sift corn meal, salt, baking powder and sugar. Add ground oats and mix well. Add water and melted shortening to beaten egg and stir into flour mixture. Bake in small muffin pan in moderately hot oven (400° F.) about 25 minutes. Yield: 8 small muffins.

CAKES AND COOKIES

Angel Food (W-M)

Ingredients:

- 4 egg whites
- ⅛ teaspoon salt
- ½ teaspoon cream of tartar
- ½ cup sifted sugar
- ½ teaspoon vanilla or almond extract
- ¼ cup potato flour

Procedure: Beat egg whites until foamy, add salt and cream of tartar, and continue beating until whites are stiff but not dry. Fold in half the sugar, then the flavoring. Mix flour and remaining sugar, sift and fold into mixture. Bake in an ungreased 8-inch tube pan in slow oven (325° F.) from 35 to 40 minutes, or bake in small ungreased muffin pans filled almost to top about 20 minutes. Yield: 1 8-inch cake or 12 to 15 medium cakes.

Little Gold Cakes (W-M)

Ingredients:

- ⅜ cup potato flour
- ¾ teaspoon baking powder
- ⅛ teaspoon salt
- 4 tablespoons shortening
- ½ cup sugar
- 4 egg yolks
- ¼ cup water
- ½ teaspoon vanilla extract

Procedure: Mix potato flour, baking powder and salt; sift. Cream shortening, add sugar slowly and cream until fluffy. Stir in well-beaten egg yolks. Add dry ingredients alternately with water, stirring well after each addition. Add vanilla extract. Fill well-greased muffin pans one half full and bake in moderate oven (350° F.) from 25 to 30 minutes. Yield: 12 to 15 small cakes.

Butterscotch Wafers (W-M)

Ingredients:

½ cup unsifted rye flour
¾ teaspoon baking powder
¼ teaspoon salt
¼ cup shortening
1 cup brown sugar, firmly packed
1 egg, well beaten
¾ cup chopped nut meats

Procedure: Mix flour, baking powder and salt. Melt shortening, stir in sugar and mix well. Remove from heat and stir in well-beaten eggs. Stir in sifted dry ingredients to which nut meats have been added. Drop by ½ teaspoonfuls on greased baking sheet and bake in slow oven (325° F.) about 15 minutes. Cool slightly, then remove carefully with a thin knife or spatula. If cookies harden on sheet, return to the oven for a few minutes. Yield: About 3½ dozen cookies 2 inches in diameter.

Oatmeal Cookies (W)

Ingredients:

1 cup unsifted rye flour
½ teaspoon baking soda
½ teaspoon salt
¼ teaspoon cinnamon
¼ teaspoon cloves
½ cup shortening
¾ cup brown sugar, firmly packed
1 egg, well beaten
¾ cup rolled oats
½ cup chopped nut meats
½ cup seeded raisins
2 tablespoons sour milk or buttermilk

Procedure: Mix flour, soda, salt and spices. Cream shortening, add sugar slowly and cream until fluffy. Stir in well-beaten egg. Add rolled oats, nut meats and raisins; mix well. Stir in dry ingredients alternately with sour milk or buttermilk. Drop by teaspoonfuls on greased baking sheet and let stand a few minutes. Flatten dough by stamping with a tumbler covered with a damp cloth. Bake in slow oven (325° F.) from 10 to 15 minutes. Yield: 3 dozen cookies 3 inches in diameter.

Quick Chocolate Drops (W-E)

Ingredients:

1⅓ cups (14½ oz. can) sweetened condensed milk
2 cups chopped nut meats or 3 cups shredded coconut
2 squares chocolate, melted

Procedure: Blend melted chocolate with condensed milk. Stir in chopped nut meats or coconut and mix well. Drop by teaspoonfuls on greased baking sheet and bake in moderate oven (350° F) from 15 to 20 minutes. Yield: 4 dozen cookies 1 inch in diameter.

Note: This recipe may be halved if there is some other use for the condensed milk. These cookies keep indefinitely, however, and it may be more practical to make up the entire recipe.

Scotch Fingers (W-E-M)

Ingredients:

1 cup ground rolled oats
¼ teaspoon salt
1½ teaspoons baking powder
2 tablespoons sugar
2 tablespoons warm water
2 tablespoons molasses
1 tablespoon melted shortening

Procedure: Mix ground oats, salt, baking powder and sugar. Stir in warm water, molasses and melted shortening; mix well. Flour board with ground rolled oats. Roll out to a very thin sheet and cut into narrow strips. Bake on a greased pan from 15 to 20 minutes in a moderately hot oven (425° F.). Yield: 24 fingers 2 inches x 1 inch.

Scottish Fancies (W-M)

Ingredients:

1 cup ground rolled oats
½ teaspoon salt
1½ teaspoons baking powder
½ cup brown sugar
1 egg, well beaten
1 tablespoon melted shortening

Procedure: Mix ground oats, salt, baking powder and sugar. Stir in egg and melted shortening; mix well. Drop from teaspoon on well-greased baking sheet. Bake in a slow oven (325° F.) until delicately brown. Remove cakes from pan while hot. Yield: 1 dozen cakes 3 inches in diameter.

Meringues (W-M)

Ingredients:

1 egg white
¼ cup sugar
Dash salt
⅛ teaspoon vanilla

Procedure: Beat the egg white until stiff and dry. Beat in gradually half the sugar and the salt. Fold in remaining sugar and vanilla extract. Drop meringues by tablespoonfuls on ungreased baking sheet, piling mixture high in center. Bake in slow oven (275° F.) from about 40 to 45 minutes (until meringues are dry on the surface and will slip off the sheet easily). Remove from sheet with wet knife. If meringues are to be served with ice cream, press in bottom crusts. Yield: 6 small meringues.

REVIEW QUESTIONS

1. Outline the use of grain in bread through history to the present day.

2. Why is wheat the chosen flour for a yeast bread? Why was refined white flour used as a staple ingredient?

3. What additions to refined flour were obligatory during World War II? Should this program be continued?

4. Compare the percentages of various nutrients in white, in enriched and in whole-wheat flours.

5. What leavenings are used for raising quick breads? Give examples of their use.

6. How does a dough differ from a batter? How should each be handled so that the texture will be fine?

7. In what conditions are flours other than wheat used in the preparation of breads and other baked products? Can the standards for wheat-flour products be applied to these?

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Inexpensive Family-Size Recipes

Chapter Topics

SOUPS
BEAN DISHES
FISH DISHES
MEAT DISHES
MISCELLANEOUS MAIN DISHES
DESSERTS
THE USE OF DRY SKIM MILK

The public-health nurse may find it necessary to help a family to utilize the food budget in such a way that food will be adequate. When a nutritionist is attached to the staff of the public agency with which the nurse works, a menu and recipe service will be available for distribution. As all social agencies do not have the advantage of the services of nutritionists, inexpensive family-size recipes are given in this chapter. The following group of recipes can be suggested by the nurse to families in need of low-priced nutritious foods. The ingredients of the recipes have been chosen with due regard for cost. Evaporated milk, for instance, is generally less expensive than fresh milk, and if dry skim milk is available its use may be demonstrated. Suggestions for the selection and the preparation of inexpensive cuts of meat and the use of fish when it is low in price may be of help when the food budget is limited. The use of green vegetables and the proper methods of cooking them to preserve food value (see Chap. 47) will be of practical value.

Kitchen equipment is often limited, and dishes which can be made with utensils on hand should be chosen. If an oven is not available, dishes which can be cooked on top of the stove should be suggested. In the absence of a measuring cup, an 8-ounce glass may be used.

SOUPS

Bean Soup

Ingredients:

1½ cups navy beans
½ cup diced carrot
2 medium-sized onions, sliced
2 bay leaves
6 cups boiling water
½ cup milk, about
Salt
Pepper

Procedure: Soak beans 12 hours and drain. Put beans, vegetables, bay leaves and water in saucepan. Cover and simmer over low heat until beans are soft, about 2 hours, stirring occasionally to prevent burning. Force through a sieve. Add enough milk to give desired consistency. Season with salt and pepper. Reheat and serve. Yield: 6 generous servings.

Note: A meat bone, if one is on hand, may be cooked with the beans. Peas and lentils may be used in place of the beans.

They may be cooked without soaking if directions on package so state.

Milk Vegetable Chowder

Ingredients:

4 tablespoons butter or other fat
1 medium-sized onion, sliced
3 cups mixed diced vegetables (potatoes, celery, carrots)
2 cups boiling water
2 cups milk or 1 cup evaporated milk diluted with 1 cup water
Salt, pepper

Procedure: Melt butter, add onion and cook 3 minutes. Add vegetables and cook 3 minutes, stirring constantly over low heat. Add water and cook until vegetables are tender. Stir in milk slowly and heat. Season to taste with salt and pepper. Yield: 6 servings.

Note: Cooked leftover vegetables may replace part of the fresh vegetables and should be added with the milk.

Fish Vegetable Chowder

Procedure: Use recipe for milk vegetable chowder. Reduce amount of diced vegetables to 1½ cups and add from ½ to ¾ lb. cut boned fish. Leftover cooked fish may be used if it is added when the vegetables are almost tender.

BEAN DISHES[1]

Baked Beans, New England Style

Ingredients:

1 quart pea beans
¾ lb. salt pork
1 tablespoon salt
1 teaspoon dry mustard
¾ cup molasses
1 cup boiling water

Procedure: Wash and pick over beans. Soak in 2 quarts cold water 12 hours. Drain, cover with fresh water, bring to boiling point and simmer over low heat until skins burst when tested. To test: Take up a few beans with spoon and blow. When skins break, the beans are tender. Drain beans and place in bean pot. Scrape rind of salt pork and cut several gashes in the meat. Press into beans. Mix salt, mustard, molasses and boiling water; pour over beans. Add more boiling water, if necessary, to cover beans entirely. Cover and bake in very slow oven (250° F.) from 6 to 8 hours. Add more water when necessary. Uncover and bake 30 minutes longer (until a brown crust has formed). Yield: 10 to 12 servings.

Note: If desired, 1 medium-sized onion, minced, may be baked with the beans.

Baked Beans, New York Style

Procedure: Follow preceding recipe for baked beans, New England style, substituting ¼ cup brown sugar, firmly packed, for the molasses. Also, marrow beans may be used to replace the pea beans. If desired, the salt pork may be sautéed from 3 to 5 minutes before combining with the beans.

Chili Con Carne

Ingredients:

2 tablespoons bacon fat
1 medium-sized onion, minced
1 clove garlic, peeled
1 lb. chopped beef
2 cups canned or cooked kidney beans
1 teaspoon salt
Pepper
½ teaspoon chili powder
2½ cups canned tomatoes
1 cup grated cheese

Procedure: Melt bacon fat in heavy frying pan, add chopped onion and garlic, and cook 3 minutes. Remove garlic, add meat and cook 2 minutes. Add kidney beans, seasonings and tomatoes; mix well. Put in greased 1½-quart casserole, sprinkle with cheese and bake in moderate oven (375° F.) from 15 to 20 minutes, or cover and cook over low heat on top of stove. Yield: 6 servings.

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[1] If an oven is not available, beans may be "baked" by simmering in a heavy covered pot on top of the stove. More liquid may be added during the cooking, if necessary.

Lima Beans, Baked

Ingredients:

¼ lb. diced salt pork
½ cup sliced onions
1 cup diced carrots
3 cups boiled dried Lima beans
2½ cups canned tomatoes

Procedure: Cook salt pork 5 minutes in heavy frying pan, add onions and carrots, and sauté over medium heat 5 minutes. Add cooked, drained Lima beans, mix well and place in greased casserole. Add tomatoes, cover and bake in moderate oven (350° F.) about 3 hours (until beans are tender). Yield: 6 servings.

Note: Use leftover baked Lima beans as foundation for soup.

FISH DISHES

Codfish, Creamed

Ingredients:

2 cups salt codfish
4 tablespoons butter or margarine
4 tablespoons flour
⅛ teaspoon pepper
2 cups milk

Procedure: Soak codfish in cold water 20 minutes to remove some of the salt; drain. Cut in small pieces. Melt butter or margarine, stir in flour and pepper, and when well blended stir in milk slowly, stirring constantly over low heat until sauce thickens and boils. Add codfish, reheat and serve. Yield: 6 servings.

Salmon, Creamed

Procedure: Follow preceding directions for creamed codfish, substituting 2 cups flaked canned salmon for the soaked codfish. One teaspoon of salt should be added to the cream sauce.

Salmon Loaf

Ingredients:

2 cups canned salmon
2 cups soft bread crumbs
½ cup milk
1 egg, well beaten
2 tablespoons melted butter or margarine
1 teaspoon salt
¼ teaspoon pepper

Procedure: Drain salmon and reserve liquor for sauce. Remove bones and skin from salmon and break into pieces. Combine fish, crumbs, milk, well-beaten egg, butter or margarine, salt and pepper. Mix well and form into a loaf. Bake in a moderately hot oven (400° F.) from about 20 to 25 minutes (until light brown). Serve with the following sauce. Yield: 6 servings.

Sauce for Salmon Loaf

Ingredients:

2 tablespoons butter or margarine
2 tablespoons flour
¼ teaspoon salt
¼ cup salmon liquor
¾ cup milk

Procedure: Melt butter or margarine, stir in flour and salt, and when well blended add salmon liquor and milk slowly, stirring constantly over low heat until mixture thickens and boils. Serve with salmon loaf.

MEAT DISHES

Goulash

Ingredients:

1 lb. stewing beef
½ lb. lean pork
2 pig or lamb kidneys
4 tablespoons bacon fat
3 tablespoons minced onion
1 cup canned tomatoes
1 teaspoon salt
⅛ teaspoon pepper
4 medium-sized potatoes, pared and cut in cubes

Procedure: Cut meat in 1-inch cubes and split kidneys. Remove membrane and tubes from kidneys, soak in salted water 30 minutes and slice. Heat bacon fat in heavy frying pan, add onion and meat, and sauté until onions and meat are brown. Add tomatoes, salt and pepper, and mix well. Cover and let simmer slowly 1 hour. Uncover, add potatoes, cover and cook until potatoes are tender. Add a little water and more salt if necessary. Yield: 6 servings.

Liver, Sautéed

Procedure: Have beef, lamb or pork liver sliced ½ inch thick. Wipe with cloth and remove skin and tubes. Dredge with flour. Cook in hot, well-greased frying pan about 5 minutes, turning occasionally until well browned. Add more fat as needed. Season with salt and pepper. Be careful not to overcook liver. Allow ¼ lb. for each serving.

Baked Liver with Vegetables

Ingredients:

1 lb. beef liver, sliced
1 teaspoon salt
¼ teaspoon pepper
4 onions
2 carrots
2½ cups canned tomatoes

Procedure: Wipe liver, season with salt and pepper. Roll in flour. Cut onions and carrots in small pieces, put in frying pan, add sliced liver and canned tomatoes. Cover. Bake in moderate oven (375° F.) or cook over low heat on top of stove about 30 minutes (until liver is tender). Add more seasoning, if necessary. Yield: 6 servings.

Meat Loaf

Ingredients:

1 cup soft bread crumbs
½ cup milk or water
1 lb. chopped beef
1 egg (may be omitted)
1 onion, finely chopped
1 teaspoon salt
⅛ teaspoon pepper

Procedure: Soak bread crumbs in milk. Add other ingredients and mix well. Place in greased baking pan and bake in moderate oven (375° F.) 30 minutes, or until brown. A chopped carrot or green pepper may be added, if desired. Yield: 6 servings.

Meat Stew

Ingredients:

2 lbs. stewing beef or lamb
1 teaspoon salt
½ teaspoon pepper
7 onions
4 cups boiling water
1 bay leaf
4 cloves
6 carrots
6 potatoes
¼ cup flour

Procedure: Wipe meat and cut in 1-inch pieces. Sprinkle with salt and pepper and brown in its own fat. Peel and slice 1 onion; cook with meat until yellow. Add water, bay leaf and cloves, cover and cook over low heat 1½ hours. Add scraped carrots and remaining peeled onions; cook ½ hour. Add peeled potatoes and cook until potatoes are tender. Mix flour with cold water to a smooth paste and stir into stew. Add more salt if necessary. Stir until gravy begins to thicken. Yield: 6 liberal servings.

Note: The carrots may be replaced by 2 cups diced turnips.

Swedish Meat Balls

Ingredients:

2 cups soft bread crumbs
¾ cup milk
2 tablespoons minced onion
¼ cup salad oil or bacon fat
1 lb. chopped beef
¼ teaspoon nutmeg
1½ teaspoons salt
¼ teaspoon paprika
1 egg, slightly beaten
2 tablespoons flour
½ cup milk

Procedure: Soak bread crumbs in milk 10 minutes. Sauté onion in half the oil or bacon fat until light brown. Add to meat with seasonings and slightly beaten egg. Add soaked bread crumbs and put mixture through meat grinder. Form in small balls and sauté in frying pan in remaining fat until light brown on all sides. Sprinkle with flour, coating each, and cook 5 minutes. Add milk, cover and cook 5 minutes. Yield: 16 to 18 small balls.

MISCELLANEOUS MAIN DISHES

Baked Macaroni with Tomatoes

Ingredients:

1 package macaroni
4 tablespoons bacon fat
1 medium-sized onion, sliced
¼ cup minced green pepper
2½ cups canned tomatoes
½ teaspoon salt
⅛ teaspoon pepper
¼ lb. sliced cheese

Procedure: Cook macaroni as directed on package, rinse, drain and arrange in greased 2-quart casserole. Melt bacon fat in frying pan, add onion and green pepper, and cook 1 minute. Add tomatoes, salt and pepper (adding more if necessary) and pour over macaroni. Cover with sliced cheese. Bake in moderately hot oven (400° F.) about 20 minutes (until cheese melts). Yield: 6 liberal servings.

Scalloped Potatoes

Ingredients:

6 medium-sized potatoes
Salt
Pepper
2 tablespoons flour
2 cups evaporated milk diluted with
2 cups water

Procedure: Wash and pare potatoes and cut in very thin slices. Place potatoes in greased 2-quart baking dish. Sprinkle with salt, pepper and flour. Pour in milk so that it can be seen through the top layer. Cover and bake in moderate oven (375° F.) 30 minutes. Remove cover and continue baking about 15 minutes longer, until potatoes are tender and a brown crust has formed on the top. Yield: 6 servings.

Note: If desired, 2 tablespoons minced onion may be added to the potatoes. Leftover minced ham may be added.

Spanish Rice

Ingredients:

¼ cup salad oil
1 clove garlic, peeled
1 medium-sized onion, minced
¼ cup chopped green pepper
3 cups boiled rice
1 teaspoon salt
2½ cups canned tomatoes

Procedure: Heat salad oil in large frying pan. Add garlic, onion, green pepper and rice, and cook 3 minutes, stirring constantly. Add salt and tomatoes. Mix well, cover and cook over low heat until tomato juice is absorbed, about 15 minutes. Yield: 6 servings.

Note: Add 1 cup chopped cooked meat, if desired.

Spaghetti, Italian Style

Ingredients:

¼ cup salad oil or bacon fat
1 clove garlic, peeled
½ lb. chopped beef or veal
3 tablespoons minced green pepper
3 tablespoons minced onion
2½ cups canned tomatoes
1 4-oz. can tomato paste
1 teaspoon salt
2 teaspoons sugar
1 cup boiling water
1 package spaghetti
Grated cheese

Procedure: Heat salad oil or bacon fat in heavy saucepan. Add garlic and chopped beef or veal, green pepper and onion, and sauté 5 minutes, stirring frequently, until meat is well browned. Remove garlic, if desired. Force tomatoes through a sieve and add tomato paste, salt, sugar and water. Let simmer uncovered over low heat about 1½ hours, until mixture is thick. Stir occasionally to prevent sticking. Cook spaghetti as directed on package, rinse, drain and arrange on hot platter. Pour sauce round it and sprinkle with cheese. Yield: 6 servings.

Toasted Cheese

Ingredients:

- 1 teaspoon salt
- ½ teaspoon dry mustard
- ½ teaspoon paprika
- ½ lb. cheese
- 2 eggs
- 1 cup milk

Procedure: Mix seasonings in greased 9-inch pie pan. Flake cheese with a fork or grate into pan. Break eggs over cheese, add milk and mix with fork. Set in pan of hot water and bake in a moderate oven (375° F.) until set, from about 35 to 40 minutes. Yield: 6 servings.

Note: One instead of 2 eggs may be used.

DESSERTS

Baked Apple Pudding

Ingredients:

- 7 ¼-inch slices bread
- 4 tablespoons butter or margarine
- 3 sliced apples
- 1 cup sugar

Procedure: Soften butter and spread bread slices. Line bottom and sides of baking dish with bread, buttered side toward the dish. Fill with apples and sugar, and cover with bread. Bake in moderate oven (375° F.) 30 minutes. Yield: 6 servings.

Baked Rhubarb Pudding

Procedure: Follow recipe for baked apple pudding, substituting 4 cups rhubarb for the apples. If rhubarb is very tart, more sugar may be added.

Baked Custard

Ingredients:

- 3 eggs, slightly beaten
- 3 tablespoons sugar
- ½ teaspoon salt
- 1½ cups evaporated milk diluted with
- 1½ cups water
- Nutmeg

Procedure: Combine slightly beaten eggs, sugar, salt and milk, and stir until sugar is dissolved. Pour into custard cups, sprinkle with nutmeg and place cups in pan of hot water. Bake in moderate oven (375° F.) until set, about 35 minutes. The custard will be cooked when mixture does not adhere to knife when inserted. Cool quickly by placing cups in cold water. Yield: 6 custards.

Bread Pudding

Ingredients:

- 3 tablespoons softened butter or margarine
- 4 to 5 ½-inch slices bread
- 2 eggs or 4 egg yolks, slightly beaten
- ¼ cup sugar
- ¼ teaspoon salt
- 1 cup evaporated milk diluted with
- 1 cup water, and scalded
- ½ teaspoon vanilla

Procedure: Butter bread and arrange in baking dish. Combine slightly beaten eggs or egg yolks, sugar and salt. Add hot milk slowly and stir until sugar is dissolved. Stir in vanilla. Pour mixture over bread, place baking dish in pan of hot water and bake in slow oven (325° F.) until custard begins to set, about 40 minutes. Serve hot or chilled. Yield: 6 servings.

Chocolate Blanc Mange

Ingredients:

- 1½ cups evaporated milk
- 1½ cups water
- 4 tablespoons cornstarch or 8 tablespoons flour
- 5 tablespoons cocoa
- 6 tablespoons sugar
- ¼ teaspoon salt
- 1 teaspoon vanilla

Procedure: Mix milk with 1¼ cups water in top of double boiler and scald over hot water. Mix cornstarch or flour, cocoa, sugar and salt. Stir in remaining water to this mixture, and when smooth stir into scalded milk. Stir over hot water until thick. Cover and continue cooking 5 minutes or more over the hot water. Stir in vanilla, pour into bowl or 6 custard cups and chill. Yield: 6 servings.

Fruit Custard Pudding

Ingredients:

1 cup evaporated milk
1¼ cups cold water
2 tablespoons cornstarch
1 egg
½ teaspoon salt
¼ cup sugar
½ teaspoon vanilla

Procedure: Mix milk with 1 cup cold water and scald in top of double boiler over hot water. Mix cornstarch with remaining cold water (¼ cup) to a smooth paste and stir into scalded milk. Beat egg slightly, add salt and sugar, and mix with a small portion of the hot mixture; then add slowly to the contents of the double boiler. Stir until thickened. Add vanilla. Serve over sliced bananas or oranges, berries or other fruit, or with cottage pudding.

Rice Pudding

Ingredients:

¼ cup rice
2 cups evaporated milk diluted with
2 cups water
½ teaspoon salt
¼ cup sugar
¼ teaspoon nutmeg

Procedure: Wash rice thoroughly and drain. Combine all ingredients and pour into well-greased baking dish. Bake in very slow oven (250° F.) about 2 hours, stirring at least 3 times during the first hour to break crust that forms. Do not stir during last hour of cooking. Chill before serving. Yield: 6 servings.

Note: Add ½ cup raisins before baking, if desired.

Scandinavian Prune Pudding

Ingredients:

½ lb. prunes
3½ cups water
1 1-inch stick cinnamon
¾ cup sugar
⅛ teaspoon salt
5 tablespoons cornstarch
1 tablespoon lemon juice

Procedure: Wash prunes, cover with 3 cups water and let stand 2 hours. Cook in covered saucepan until soft, about 20 minutes. Drain, save juice and pit prunes. Return fruit and juice to saucepan, and add cinnamon. Combine sugar, salt and cornstarch. Mix with remaining cold water and add to fruit. Cook over low heat, stirring constantly, until mixture thickens, about 5 minutes. Remove cinnamon, add lemon juice, pour into mold and chill. Yield: 6 servings.

Molasses Cake

Ingredients:

2¼ cups sifted flour
¾ teaspoon baking soda
1 teaspoon baking powder
½ teaspoon salt
1 teaspoon cinnamon or allspice
1 teaspoon ginger
½ teaspoon cloves
1 egg
½ cup melted shortening
1¼ cups molasses
¾ cup hot water

Procedure: Mix and sift dry ingredients. Beat egg, stir in melted shortening and molasses. Add sifted dry ingredients alternately with hot water, beating well after each addition. Bake in a greased 9 x 9 x 2 pan in moderate oven (350° F.) 45 minutes. Cut into squares; serve hot or cold. Yield: 16 portions.

One-Egg Cake (Cottage Pudding)

Ingredients:

2 cups sifted flour
3 teaspoons baking powder
¼ teaspoon salt
¼ cup shortening
1 cup sugar
1 egg
¾ cup milk
1 teaspoon vanilla

Procedure: Mix and sift flour, baking powder and salt. Cream shortening, add sugar slowly and cream until fluffy. Add unbeaten egg and beat well. Add sifted dry ingredients alternately with milk, stirring well after each addition. Add vanilla. Bake in 2 greased 9-inch layer-cake pans, or in greased muffin pans, in moderate oven (375° F.) about 25 minutes, or bake in 1 greased 8-inch square pan in moderate oven (350° F.) about 50 minutes. Cool and frost as desired or use hot with sauce for cottage pudding. Yield: 2 layers, about 16 medium-size cup cakes or 1 square.

Molasses Cookies

Ingredients:

1 teaspoon soda
1 tablespoon warm water
2½ cups sifted flour
1 teaspoon ginger
1 teaspoon cinnamon
¼ teaspoon salt
½ cup shortening
½ cup sugar
½ cup molasses

Procedure: Dissolve soda in warm water and set aside to cool. Mix and sift flour, spices and salt. Cream shortening, add sugar slowly and cream until fluffy. Stir in molasses. Add sifted dry ingredients and blend thoroughly. Stir in cold soda and water mixture. Add more flour if necessary to make a stiff dough. Roll out thin on a lightly floured board. Cut into shapes and bake in a moderate oven (375° F.) from 8 to 10 minutes. Yield: 4 dozen cookies.

THE USE OF DRY SKIM MILK

Dry skim milk is to be found in some city markets and, according to present expectations, will be obtainable generally before long. As this is the most inexpensive form of milk, it can be used to great advantage in the limited food budget. Another advantage is that it can be kept in the package on the kitchen shelf without refrigeration. It has the same food value as skimmed fresh milk. Standard recipes may be used if the powdered dry milk is combined with water in equal amount to the milk indicated in the recipe.

Reconstitution of Dry Skim Milk

Ingredients:

3 tablespoons dry skim milk + 1 cup water can be used instead of 1 cup milk
6 tablespoons dry skim milk + 1 pint water can be used instead of 1 pint milk
¾ cup (12 tbsps.) dry skim milk + 1 quart water can be used instead of 1 quart milk

Procedure: To make dry skim milk into liquid skim milk, just mix it with water in either of the following ways:

Method 1: Pour water into mixing bowl. Sprinkle dry skim milk on top of water. Beat with rotary egg beater until dry skim milk dissolves, occasionally scraping down any powder clinging to bowl.

Method 2: Pour water into jar or shaker large enough so that water only about half fills it. Sprinkle dry skim milk on top of water. Cover tightly and shake until dry skim milk dissolves.

When made into liquid skim milk, keep in cool place just as you would fresh milk.

In some recipes, you may find it more convenient to use dry skim milk in dry form. To use dry skim milk in dry form, just add dry skim milk to the other dry ingredients such as flour and salt, and then use water as the liquid in the recipe. For example, if your recipe calls for 1 cup milk, add 3 tablespoons dry skim milk to other dry ingredients before mixing or sifting. Then follow recipe but use 1 cup water instead of the cup of milk listed in recipe.

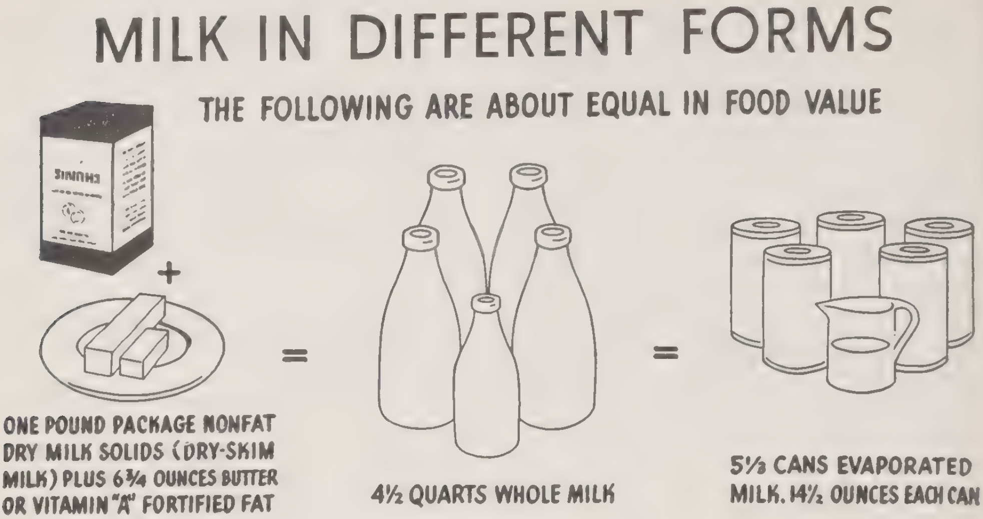
MILK IN DIFFERENT FORMS
THE FOLLOWING ARE ABOUT EQUAL IN FOOD VALUE
+
=
=
ONE POUND PACKAGE NONFAT DRY MILK SOLIDS (DRY-SKIM MILK) PLUS 6¾ OUNCES BUTTER OR VITAMIN "A" FORTIFIED FAT
4½ QUARTS WHOLE MILK
5⅓ CANS EVAPORATED MILK. 14½ OUNCES EACH CAN

Fig. 127.

Special Recipes for Using Dry Skim Milk

Dry skim milk may be used conveniently in some recipes without reconstituting with water.

Basic Cream Sauce

Ingredients:

2 tablespoons fat
2 tablespoons flour
3 tablespoons dry skim milk
½ teaspoon salt
1 cup water (or water in which vegetables were cooked)

Procedure: Melt fat. Remove from heat. Mix flour, dry skim milk and salt. Add to fat, mixing until well blended. Gradually add water, stirring until well mixed. Cook over low heat, stirring constantly until thick and smooth, about 5 minutes. Yield: about 1 cup.

Potato Chowder

Ingredients:

1 teaspoon salt
6 cups boiling water
4 medium-sized potatoes, thinly peeled and sliced
1½ cups dry skim milk
¼ lb. salt pork, diced, or 3 tablespoons vegetable shortening
1 medium-sized onion, sliced
1 green pepper, diced
4 tablespoons chopped celery leaves, if desired

Procedure: Add salt to the boiling water and boil potatoes 5 or 8 minutes, or until tender. Drain. Save water. There should be from 4½ to 5 cups. Mash potatoes. Gradually beat in ½ cup dry skim milk with fork or spoon. Beat in ½ cup reserved potato water. Add remaining dry skim milk. Mix well. Add remaining potato water. Cook salt pork until browned. Add onion, green pepper and celery leaves. Cook 5 minutes, or until tender and lightly browned. Add to potato mixture. Bring to boiling point, stirring frequently. Yield: 4 to 5 servings.

Fish Chowder

Ingredients:

3 tablespoons fat
2 medium-sized onions, sliced
2 cups diced potatoes (about 2 medium sized)
¾ lb. fish, cut in pieces (uncooked)
1 carrot, sliced, if desired
2 teaspoons salt
¼ teaspoon pepper
7½ cups water
3 tablespoons flour
1½ cups dry skim milk

Procedure: Melt drippings. Add onions. Cook until soft and light brown in color. Add potatoes, fish, salt, pepper, carrot and 6½ cups water. Cover and cook gently about 15 minutes or until potatoes are tender. Mix together flour and dry skim milk. Slowly add remaining 1 cup of water, mixing until smooth. Add to chowder, stirring constantly. Cook 5 minutes or until thickened. Yield: 6 generous servings.

Creamed Noodles with Carrots

Ingredients:

2 cups diced carrots
½ package noodles
3 tablespoons drippings
1 medium-sized onion, sliced
¾ cup dry skim milk
4 tablespoons flour
1 teaspoon salt
⅛ teaspoon pepper
2 cups carrot stock
¾ to 1 cup leftover diced chicken or meat, if available, or ½ cup grated cheese

Procedure: Cook carrots covered in 2¼ cups boiling salted water until tender. Drain and reserve liquor. Cook noodles in generous amount of boiling salted water until tender and drain. Melt drippings in frying pan, add onion and cook over low heat until yellow. Mix dry skim milk, flour, salt and pepper. Sprinkle over the reserved carrot liquor and beat until well blended. Add slowly to onions, while stirring constantly over low heat. Continue stirring until slightly thickened. Add drained carrots and noodles and chicken or meat, if available. Heat to bubbling. Add cheese if meat has been omitted. Stir just until cheese melts. Serve on toast or with mashed potatoes. Yield: 6 servings.

Note: Leftover cooked carrots and noodles (2 cups) may be used. Water may replace the carrot stock. String beans, peas or cabbage, or a mixture of vegetables, may replace the carrots.

Apple Crumble

Ingredients:

½ cup sifted flour
¾ cup dry skim milk
¼ cup butter, margarine or other shortening
3 tablespoons sugar
¼ teaspoon nutmeg
¼ teaspoon salt
1 teaspoon cinnamon, if desired
3 cups sliced apples (or about 2 large apples, sliced)

Procedure: Mix flour, dry skim milk, sugar, numeg, salt and cinnamon. Cut shortening in with 2 knives or pastry blender until mixture is crumbly.

Arrange apples in shallow, well-greased baking dish. Sprinkle apples with flour mixture. Bake in moderate oven (350° F.) about 25 minutes, or until apples are tender. Remove cover and bake 10 minutes longer, or until crumbs are brown. Good hot or cold with milk or cream. Yield: 6 servings.

Baked Custard

Ingredients:

⅔ cup dry skim milk
½ cup sugar
¼ teaspoon salt
3 eggs, slightly beaten
3 cups boiling water
½ teaspoon vanilla
Few grains nutmeg

Procedure: Add dry skim milk, sugar and salt to eggs. Mix well with fork. Gradually add water and vanilla. Fill custard cups. Sprinkle with nutmeg. Place in pan of hot water and bake in a moderate oven (375° F.) about 30 minutes, or until knife inserted in center comes out clean. Yield: 6 servings.

Part Four

TABULAR MATERIAL AND SPECIAL TESTS

Table 1

Composition of Foods Including Minerals and Vitamins

EXPLANATION OF TABLE 1

COMPOSITION OF FOODS

Simplified for Ease in Calculation. This table of food values, designed for the use of students and laymen, has been greatly simplified for their convenience without sacrificing accuracy unduly. Research in food values has demonstrated repeatedly that the composition of food is variable because of differences in its variety, the soil and the climate where it is grown and its condition when analyzed. The values for most foods are averages of several determinations, sometimes of a wide range, and are usually calculated to one or two decimal places. It seems futile, however, to retain decimals in a food table to be used for approximate calculations when in most cases they do not make for greater accuracy in final results. Thus the figures for protein, fat, carbohydrate, water and fiber have been rounded to the nearest whole number. For calcium and phosphorus two decimal places are retained, and for iron, niacin and biotin one decimal place in order to provide a similar degree of accuracy for the various nutrients.

The designation Tr, meaning trace, has been used on the left-hand pages to indicate values which would have rounded to zero according to usual procedures. For purposes of calculation these traces will be considered zero, but it seems less misleading to recognize the presence of small amounts of substances where they exist than to indicate a zero in the table. Thus Tr means 0.4 Gm. or less in the protein, fat, carbohydrate and fiber columns.

Carbohydrate and Caloric Values. The conventional procedure of calculating calories by use of the Atwater factors 4, 9 and 4 calories per Gm. of protein, fat and carbohydrate (total "by difference"), respectively, has been followed in this tenth edition. Maynard[1] in 1944 recommended that nutrition publications in the United States follow the policy outlined in Atwater's original publication in which he gave the derivation of these factors and explained the corrections made for fiber and losses in digestion. While there are obvious inaccuracies in such a method, the attempt to overcome such inaccuracies by the use of "available" carbohydrate figures in the calculations, as was done in previous editions, introduces still other inaccuracies and this has therefore been discontinued.

The caloric value of foods varies not only according to the organic composition but to the water content. The increasing emphasis on the water content of foods in calculating therapeutic diets also pointed to the need for including water in the present table of food values.

Sources of Data. The values in this table are derived from the latest available sources. Accepted as final authority for the specific foods listed

[1] Maynard, L. A.: J. Nutrition 28:443, 1944.

therein is the "Tables of Food Composition in Terms of 11 Nutrients" (see Ref. No. 1), 1945. The preface to these tables should be read by every student for a better understanding of food-value tables in general. Values for foods not listed in this bulletin, or for factors not included, are drawn from various other reliable sources. These, however, are not always as recent. The entire list of foods is given in convenient alphabetical order rather than by food groups.

Variability in Composition of Foods. Comments of Chatfield and Adams (Ref. No. 3) concerning the variability in composition of natural foods given in three quoted paragraphs serve to justify further the use of whole numbers for the proximate composition of food. These same variables are bound to affect mineral and vitamin content as well:

> Fruits vary in their sugar, acid and water content over a wide range, depending on the variety, the amount of sunlight during the growing period, the stage of maturity and the length and conditions of storage. The fiber content of the part eaten may be less than half as much when the fruit is peeled and the seeds or other fibrous but edible parts are removed as it is when such parts are included.
>
> Vegetables vary in much the same way. Meats vary in all the constituents of the edible portion depending, first, on the proportion of separable lean and fat in the particular piece and, second, on the fatness of the animal. Fish of some one species may have eight or ten times as much fat, and at the same time somewhat more protein, at one season than at another.
>
> Besides these natural variations in fresh materials, others are introduced in many cases through processing. Fruits may be canned in plain water or in sirups ranging in concentration from light to very heavy; when fruits are dried the amount of water left in them is far from constant; likewise with vegetables. Grains are milled variously, and the highly specialized foods, such as breakfast cereals, crackers and cakes, can be made from various mixtures of ingredients; and the manufacturer may change these ingredients and their proportions from time to time. Meats, fish and shellfish when cured in various ways are desiccated to some extent; salt is usually added, much or little, and the composition of the resulting material, which was variable beforehand, becomes even more so. Still further variations in almost any food are introduced by cooking.

The composition of prepared dishes such as soups, stews, cakes, pies and puddings listed in the table will vary obviously with the recipe and the method of preparation. The values should be considered only approximate.

Mineral Values. No attempt has been made to indicate mineral losses which may occur in cooking or to give the degree of availability. Where oxalic acid is present in sufficient amounts to interfere greatly with the availability of calcium this is so indicated by a footnote. Bowes and Church (Ref. No. 2) suggest that allowances be made for losses of minerals in boiled vegetables: 10 to 35 per cent for calcium and phosphorus, 25 to 50 per cent for iron. These losses would be much less if water were retained and used.

Vitamin Values. Extensive research in vitamin values of both raw and prepared foods has improved the reliability of the figures and at the same time has emphasized the wide range of variability possible. In many instances an indication of the range of vitamin values for a single food might have offered the student a better concept of such variability, but it would not have indicated which value to use in calculation. Thus one most representative value has usually been given for each vitamin in a food. Many of these figures will again be revised as more data become available. Although the significance of pantothenic acid, pyridoxine and biotin in human nutrition is not yet understood, there is sufficient evidence of their physiologic value to make their distribution in foodstuffs worth recording so far as data exist. Obviously these figures cannot be used in calculating total food values, as are the other figures in the table.

Losses of vitamin values in storage, in cooking, in canning and in drying are discussed in Chapter 8 on Vitamins and in Part Three.

Fresh, Frozen, Canned and Dried Foods. Figures in the table are for the edible portion of fresh or raw foods, unless otherwise stated. Quick-frozen fruits, meats and vegetables retain essentially the same values as the fresh products and are, therefore, not listed separately. In fact, frozen products often are better sources of vitamins than so-called fresh products shipped long distances. Analyses of canned fruits and vegetables refer to the total contents of the can and thus they apply to servings which include a proportionate share of the liquid in the can.

Dehydrated vegetables used chiefly in army rations during the war are not included in this table. The dried fruits and the legumes listed are those commonly on the retail markets.

Enriched, Fortified and Restored Foods. Processed foods which have been enriched, restored or fortified by the addition of minerals or vitamins are so indicated, but accurate values for any trade-name product should be obtained from the package or direct from the manufacturer. Vitamin values for baked goods such as cakes, cookies and muffins are for products made from unenriched flour unless otherwise indicated.

Explanation of Terms and Format. In using the table the following points should be noted: All values are given for 100-Gm. portions, even though this may not be the average-size serving of some foods. Reference to the approximate measure of 100 Gm. given following each food will make it easy to estimate the proportion of 100 Gm. usually served. These measures are approximate only and common household measures are used. The food values given are based on the edible portion only. A series of dots (. . .) indicates that no reliable figure is available; (0) means that there is none or an insignificant amount of a factor present; (Tr) means a trace as explained in an earlier paragraph.

The units recorded at the head of each column should be noted. Most food constituents may now be listed in appropriate metric units, except for vitamins A and D. The metric unit for each constituent is chosen so as to give whole-number values as far as feasible. Therefore, micrograms (mcg.) are used for all fractions of the B complex except niacin, because the amounts present are so small. Human requirements are usually stated in milligrams (mg.). The various units are used as follows in the table.

Grams (Gm.) for protein, fat, carbohydrate, fiber, calcium and phosphorus

Milligrams (mg.) for iron, niacin and ascorbic acid (1,000 mg. = 1 Gm.)

Micrograms (mcg.) for thiamine, riboflavin, pantothenic acid, pyridoxine and biotin (1,000 mcg. = 1 mg.)

International Units (I.U.) for vitamins A and D

CHIEF REFERENCES USED IN COMPILING FOOD TABLES

1. Bureau of Human Nutrition and Home Economics: Tables of Food Composition in Terms of 11 Nutrients, U. S. Department of Agriculture, Misc. Pub. No. 572, 1945.

2. Bowes and Church: Food Values of Portions Commonly Used, Philadelphia, College Offset Press, 1945.

3. Chatfield and Adams: Proximate Composition of American Food Materials, U. S. Department of Agriculture, Circ. No. 549, 1940.

For other references on food composition see classified list of references on pages 670-678.

TABLE 1

PROXIMATE COMPOSITION OF FOODS

(Calculated for 100 Gram Portions)

Foods Approx. Measure of 100 Gm.	Protein Gm.	Fat Gm.	Carbohydrate Gm.	Calories	Minerals			Water Gm.	Fiber Gm.
					Ca Gm.	P Gm.	Fe mg.		
1. **Almonds,** ¾ c.:									
Unblanched........	19	54	20	642	.25	.48	4.4	5	3
Blanched, salted....	20	57	17	661	...	...	....	4	..
2. **Apples,** 1 sm.:									
Raw..............	Tr.	Tr.	15	60	.01	.01	.3	84	1
Baked (unsweetened)	Tr.	Tr.	15	60	.01	.01	.3	84	1
3. **Apple juice,** ½ c......	Tr.	0	13	52	...	...	....	86	
4. **Apple sauce,** ½ c.:									
Sweetened.........	Tr.	Tr.	20	80	.01	.02	.2	80	1
5. **Apricots:**									
Fresh, 3 med.......	1	Tr.	13	56	.02	.02	.5	85	1
Canned, 6 halves:									
In sirup.........	1	Tr.	21	88	.01	.02	.7	87	Tr.
Water pack......	1	Tr.	8	36	.01	.02	.7	90	Tr.
Dried, ½ c.........	5	Tr.	67	288	.08	.12	4.9	24	3
6. **Artichokes, globe or French,** 1 sm.......	3	Tr.	12	60	.04	.09	.09	85	3
7. **Artichokes, Jerusalem,** 2 med.:									
Fresh.............	2	Tr.	17	76	...	...	....	81	1
Cooked............	2	Tr.	...	(20)	.03	.03	.4		
8. **Asparagus,** 6 stalks:									
Fresh tender.......	2	Tr.	4	24	.02	.06	1.0	93	1
Cooked or canned...	2	Tr.	4	24	.03	.04	.9	94	1
9. **Avocados,** ½ med.....	2	26	5	262	.01	.04	.6	65	2
10. **Bacon,** 6 slices:									
Medium fat.........	9	61	1	625	.01	.11	.8	25	0
11. **Bamboo shoots,** ¾ c...	3	Tr.	5	32	.01	.04	.7	92	1
12. **Bananas,** 1 sm.........	1	Tr.	23	96	.01	.03	.6	75	1
13. **Barley,** ½ c.:									
Pearled...........	8	1	79	357	.02	.19	2.0	11	1

Table 1 (*Continued*)

VITAMINS IN FOODS

(Calculated for 100 Gram Portions)

Foods (Full description on opposite page)	Vitamin A I.U.	Vitamin B Complex						Ascorbic Acid mg.	Vitamin D I.U.
		Thiamine mcg.	Riboflavin mcg.	Niacin mg.	Pantothenic Acid mcg.	Pyridoxine mcg.	Biotin mcg.		
1. Almonds:									
Unblanched	....	246	670	4.6	.....	...	.....	0–15	...
Blanched	....	...	..	...		..	....	..	...
2. Apples:									
Raw	90	40	20	.2	60	26	.9	5	...
Baked	90	15	...	.....	.....	...	.....	1–6	...
3. Apple juice	57	20	...	.....	.....	...	.....	3	...
4. Apple sauce:									
Sweetened	60	16	10	.....	.....	...	.....	1	.
5. Apricots:									
Fresh	2,790	30	40	.7	.....	...	.....	4	.
Canned:									
In sirup / Water pack	1,350	20	20	.3	89	...	.....	2	...
Dried	7,400	10	160	3.3	.	..	....	12	...
6. Artichokes, globe	200	232	10	.....	.....	...	.....	9	..
7. Artichokes, Jerusalem:									
Fresh	....	189	...	.....	.....	...	.....	4	.
Cooked	...	...	.	..	...	...	....	..	.
8. Asparagus:									
Fresh Green	1,000	160	170	1.2	.....	...	.....	33	...
Fresh Bleached	50	...	.	...	..	..	..	30	..
Canned Green	600	60	90	.8	200	...	.....	15	
Canned Bleached	50	50	53	.6	130	...	.....	15	
9. Avocados	290	120	150	1.1	.....	...	.....	16	
10. Bacon:									
Medium fat	0	400	67	1.9	280	29	7.4	0	
11. Bamboo shoots	22	50	...	.2	.....	...	.....	9	
12. Bananas	430	90	60	.6	180	320	4.4	10	...
13. Barley:									
Pearled	0	120	80	3.1	.....	...	.....	0	..

TABLE 1 (*Continued*)

PROXIMATE COMPOSITION OF FOODS

(Calculated for 100 Gram Portions)

Foods Approx. Measure of 100 Gm.	Protein Gm.	Fat Gm.	Carbohydrate Gm.	Calories	Minerals			Water Gm.	Fiber Gm.
					Ca Gm.	P Gm.	Fe mg.		
1. Beans:									
Kidney, canned, ½ c.	6	Tr.	16	88	.04	.20	2.3	76	1
Lima, ⅔ c.:									
Fresh	8	1	24	137	.06	.16	2.3	67	2
Cooked or canned	4	Tr.	14	72	.03	.07	1.7	81	1
Dried	21	1	62	341	.07	.38	7.5	13	4
Navy (also dried kidney, pinto, pea beans), ½ c.:									
Dried	22	2	62	354	.15	.46	10.3	11	4
Baked	6	2	19	118	.05	.15	3.4	71	1
Snap, green or wax:									
Fresh, ¾ c. cut	2	Tr.	8	40	.06	.04	1.1	89	1
Cooked, ½ c.	1	0	4	20	.03	.02	1.4	94	1
Soy (*See* Soybeans)									
2. Bean sprouts, 1 c.:									
Fresh, mung	3	Tr.	4	28	.04	.10	1.0	92	1
(*See* Soybean sprouts)									
3. Bean flour, lima, ¾ c.	22	1	63	349	...	...	....	13	2
4. Beef, 3½ oz. raw: (*See* Meat, Cooked, for average composition after cooking.)									
Oven roasts, med. fat:									
Chuck	19	16	0	220	.01	.20	2.8	64	0
Loin	17	25	0	293	.01	.18	2.5	57	0
Rib	17	23	0	275	.01	.19	2.6	59	0
Round	19	13	0	193	.01	.21	2.9	67	0
Rump	16	31	0	343	.01	.17	2.3	52	0
Pot roasts, med. fat:									
Chuck	19	16	0	220	.01	.20	2.8	64	0
Round	19	13	0	193	.01	.21	2.9	67	0
Rump	16	31	0	343	.01	.17	2.3	52	0
Shank	20	9	0	161	.01	.22	3.0	70	0
Steaks, med. fat:									
Club, T-bone, porterhouse and sirloin	17	25	0	293	.01	.19	2.5	67	0
Flank	17	30	0	338	.01	.19	2.6	52	0
Rib	17	23	0	275	.01	.19	2.6	59	0
Round	19	13	0	193	.01	.21	2.9	67	0

Table 1 (*Continued*)

VITAMINS IN FOODS

(Calculated for 100 Gram Portions)

Foods (Full description on opposite page)	Vitamin A I.U.	Vitamin B Complex						Ascorbic Acid mg.	Vitamin D I.U.
		Thiamine mcg.	Riboflavin mcg.	Niacin mg.	Pantothenic Acid mcg.	Pyridoxine mcg.	Biotin mcg.		
1. Beans:									
Kidney	50	96	...	.....	.....	...	.....	...	
Lima:									
Fresh	280	250	140	.9	.....	...	.....	32	
Canned	130	30	50	.5	110	...	.....	8	
Dried	0	600	240	2.1	830	550	9.8	2	...
Navy, etc.:									
Dried	0	600	240	2.1	.....	...	.....	2	...
Baked canned N.E. style	30	21	54	.2	81	...	.....	2	...
Baked canned With tomato	70	50	50	.8	100	...	.....	4	...
Snap:									
Fresh:									
Green	630	80	100	.6	.....	...	.....	4	...
Wax	580	85	100	.8	.....	...	.....	19	...
Cooked	same as fresh	50	80	.6	.....	...	.....	4	...
Canned	410	30	50	.3	72	...	.....	4	...
2. Bean sprouts:									
Fresh, mung	35	30	120	.3	.....	...	.....	120	...
3. Bean flour, lima	......	.....	...	.....	.....	...	.....	...	
4. Beef, cooked: (Vitamin content after cooking 100 Gm. [raw wt.])									
Oven roasts:									
Chuck	0	85	135	4.5	.....	...	.....	0	...
Loin	0	75	115	4.1	.....	...	.....	0	...
Rib	0	75	125	4.2	.....	...	3.4	0	...
Round	0	85	135	4.7	800	200	4.0	0	
Rump	0	67	108	3.8	.....	...	.....	0	...
Pot roasts:									
Chuck	0	85	140	4.8	.....	...	.....	0	...
Round	0	85	140	4.9	.....	...	4.0	0	
Rump	0	67	125	4.0	.....	...	.....	0	
Shank	0	85	150	5.2	.....	...	.....	0	
Steaks:									
Club, T-bone, porterhouse, sirloin	0	85	125	4.3	400	...	.....	0	
Flank	0	40	85	2.9	.....	...	.....	0	
Rib	0	85	135	4.5	.....	...	3.4	0	
Round	0	100	140	4.9	.....	250	4.0	0	

TABLE 1 (*Continued*)

PROXIMATE COMPOSITION OF FOODS

(Calculated for 100 Gram Portions)

Foods Approx. Measure of 100 Gm.	Protein Gm	Fat Gm.	Carbohydrate Gm.	Calories	Minerals			Water Gm.	Fiber Gm.
					Ca Gm.	P Gm.	Fe mg.		
1. **Beef** (*Continued*):									
Stew cuts:									
Chuck	19	16	0	220	.01	.20	2.8	64	0
Flank	17	30	0	338	.01	.19	2.6	52	0
Shank	20	9	0	161	.01	.22	3.0	70	0
Stew meat, brisket	16	30	0	334	.01	.17	2.4	53	0
Beef, corned, med. fat	16	25	0	289	.01	.17	3.8	54	0
Canned	25	12	0	208	.01	.12	3.8	57	0
Hash, canned ½ c.	13	6	0	142	.02	.20	3.8	70	0
Beef, dried, ¾ c.	34	6	0	190	.02	.37	5.1	48	0
2. **Beef broth** (*See* Bouillon)									
3. **Beef juice**, ½ c.	5	1	0	29	.01	.03	4.4	93	0
4. **Beef heart, kidney, liver, sweetbreads** (*See* Heart, Kidney, etc.)									
5. **Beef stew** (with potatoes, carrots, onions, gravy)	6	3	16	115	.03	.91	1.5	..	1
6. **Beets:**									
Fresh, ⅔ c. diced	2	Tr.	10	48	.03	.04	1.0	88	1
Canned, ⅝ c.	1	Tr.	9	40	.01	.03	.6	89	1
Sieved, ½ c.	1	Tr.	9	40	.01	.03	.6	89	1
7. **Beet greens:**									
Fresh, 2¼ c.	2	Tr.	6	32	*	.05	3.2	90	1
Cooked, ½ c.	2	Tr.	3	20	....	....	.....		
8. **Beverages, alcoholic** (*See* p. 408)									
9. **Beverages, carbonated,** ½ c. or 4 oz. bottle:									
Ginger ale	0	0	9	36	...	...	....	91	0
Others, cola type	0	0	12	48	...	...	....	88	0

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* Ca .12 mg.; may not be available because of the presence of oxalic acid.

Table 1 (*Continued*)

VITAMINS IN FOODS

(Calculated for 100 Gram Portions)

Foods (Full description on opposite page)	Vitamin A I.U.	Vitamin B Complex						Ascorbic Acid mg.	Vitamin D I.U.
		Thiamine mcg.	Riboflavin mcg.	Niacin mg.	Pantothenic Acid mcg.	Pyridoxine mcg.	Biotin mcg.		
1. Beef (*Continued*):									
Stews:									
Chuck	0	60	150	5.0	.....	240	.....	0	. .
Flank	0	35	90	3.0	.....	...	.....	0	...
Shank	0	60	160	5.5	.....	...	.....	0	...
Stew meat, brisket	0	50	125	4.3	.....	...	.....	0	. .
Beef, corned, cooked	0	20	70	1.0	.....	...	.....	0	.
Canned	0	20	180	2.8	.....	...	.....	0	...
Hash	15	110	79	2.0	.....	...	.....	0	
Beef, dried	0	110	220	3.7	.....	...	.....	0	
2. Beef broth									
3. Beef juice	......	..	...	..		.	...		
4. Beef-heart, kidney, liver, sweetbreads, tongue									
5. Beef stew (vegetables cooked less than 1 hour)	660	80	70	1.4	.....	...	.....	4	
6. Beets:									
Fresh	20	30	50	.4	110	13	.3	10	—
Canned	20	10	30	.1	100	...	.....	5	
Sieved	20	15	27	.....	.....	...	.....	. .	---
7. Beet greens:									
Fresh	6,700	50	170	.3	140	37	2.7	34	.
Cooked	6,000	40	...	.....	.....	...	.....	10	---
8. Beverages, alcoholic									
9. Beverages, carbonated:									
Ginger ale	......	.....	...	.....	.....	...	.....		
Others, cola type	......	.....	...	.....	.....	...	.....		

Table 1 (*Continued*)

PROXIMATE COMPOSITION OF FOODS

(Calculated for 100 Gram Portions)

Foods Approx. Measure of 100 Gm.	Protein Gm.	Fat Gm.	Carbohydrate Gm.	Calories	Minerals			Water Gm.	Fiber Gm.
					Ca Gm.	P Gm.	Fe mg.		
1. **Beverages, fruit** (*See* Lemonade, Orangeade, Grape juice, etc.)									
2. **Beverages, milk and egg types,** ½ c.:									
Chocolate malted milk	4	6	13	122	.13	.08	.3	76	
Chocolate eggnog	6	6	9	114	...	...	....	78	...
Cocoa, half milk	3	2	6	54	.06	.07	.2	88	
Eggnog	5	5	9	101	.15	.11	.8	80	
Malted milk	6	1	35	173	.12	.06	.2	57	...
3. **Biscuits, Enriched:**									
Baking powder or soda, 3 med.	7	13	46	329	.02	.03	.9	33	Tr.
4. **Blackberries:**									
Fresh, 1⅙ c.	1	1	12	61	.03	.03	.9	84	4
Canned, ½ c.:									
Water pack	1	1	9	49	...	...	....	87	2
Juice pack	1	1	11	57	...	...	....	85	3
In sirup	1	1	19	89	.03	.01	.4	77	3
5. **Blackberry juice,** ½ c.	Tr.	0	8	32	...	...	....	90	0
6. **Blueberries,** ¾ c.:									
Fresh	1	1	15	73	.02	.01	.8	83	1
Canned ½ c.:									
Juice pack	Tr.	Tr.	11	44	...	...	....	89	1
In sirup	Tr.	Tr.	26	104	...	...	....	73	1
7. **Bouillon,** ½ c.	2	0	0	8	...	...	....	98	0
8. **Brazil nuts,** 12 shelled	14	66	11	694	.12	.59	.39	8	2
9. **Breads,** 3 slices:									
Boston brown	5	3	41	211	.05	.18	3.0	50	1
French, enriched	8	1	55	261	.03	.09	2.0	35	Tr.
Gluten	25	4	30	256	...	...	....	40	Tr.
Raisin, enriched	9	3	53	275	.05	.10	2.0	34	1
Rusks (5 slices)	13	7	71	399	.09	.08	2.7	8	1
Rye, American	9	2	50	254	.02	.15	1.6	38	1
Rye, pumpernickel (2 sl.)	7	1	50	237	...	...	....	41	1

TABLE 1 (*Continued*)

VITAMINS IN FOODS

(Calculated for 100 Gram Portions)

Foods (Full description on opposite page)	Vitamin A I.U.	Vitamin B Complex						Ascorbic Acid mg.	Vitamin D I.U.
		Thiamine mcg.	Riboflavin mcg.	Niacin mg.	Pantothenic Acid mcg.	Pyridoxine mcg.	Biotin mcg.		
1. Beverages, fruit									
2. Beverages:									
Chocolate malted milk	300	46	170	.1	....	...	....	...	
Chocolate eggnog	......				. .	.	....	...	.
Cocoa	150	40	150	.1	....	. .	...	. .	
Eggnog	330	80	230	.1	. .	...	...	. .	
Malted milk	320	60	200	.	. . .	...	...	...	
3. Biscuits, Enriched:									
Baking powder	190	200	116	.7	. .	. .	...	0	
4. Blackberries:									
Fresh	100	22	30	.3	....	. .	....	7	.
Canned:									
Water pack Juice pack In sirup	50	9	19	.2	78	. .	. .	3	. .
5. Blackberry juice	80				.	.		7	
6. Blueberries:									
Fresh	280	30	70	.3	. .	. .	.....	16	. .
Canned:									
Juice pack	.....		.	. .	....	.		. .	.
In sirup	70	.	14	.2	68	. .			
7. Bouillon	.				. .			0	
8. Brazil nuts	10	1,020							
9. Breads:									
Boston brown	146	150	106						.
French, enriched	......	240	155	2.2					
Gluten	....	.							
Raisin, enriched	20	220	144	1.9				. .	
Rusks	......	. .	.					.	
Rye, American	.	140	28	.8					
Rye, pumpernickel		210	. .						

TABLE 1 (*Continued*)

PROXIMATE COMPOSITION OF FOODS

(Calculated for 100 Gram Portions)

Foods Approx. Measure of 100 Gm.	Protein Gm.	Fat Gm.	Carbohydrate Gm.	Calories	Minerals			Water Gm.	Fiber Gm.
					Ca Gm.	P Gm.	Fe mg.		
1. **Breads** (*Continued*):									
White, plain	9	2	52	262	.05	.09	.9	36	Tr.
White, enriched *	9	2	52	262	.06	.10	1.8	36	Tr.
Whole wheat (graham)	10	4	48	268	.06	.37	2.6	37	1
Zwieback, 12 pieces	11	9	74	421	...	...	....	5	Tr.
2. **Broccoli** (two 5-in. stalks)	3	Tr.	6	36	.13	.07	1.3	90	1
3. **Brussels sprouts,** 7 med. 1½″ diam.	4	1	9	61	.03	.08	1.3	85	1
4. **Buckwheat flour,** ¾ c.:									
Dark	12	2	72	354	...	...	....	13	1
Light	6	1	80	353	.01	.09	1.0	12	Tr.
Pancake, self-rising	11	2	70	342	...	...	....	12	1
5. **Butter,** ½ c., 8 tbsp.	1	81	Tr.	733	.02	.02	.2	16	0
6. **Buttermilk,** ½ **c.:**									
Genuine	3.5	1	5	43	.11	.10	.1	90	0
Cultured skim milk	3.5	Tr.	5	34	.12	.09	.1	91	0
7. **Butternuts,** ¾ c.	24	61	8	677	...	...	6.8	5	..
8. **Cabbage:**									
Fresh, 1½ c. chopped:									
Head	1	Tr.	5	24	.05	.03	.5	93	1
Outer leaves	1	Tr.	5	24	.63	...	1.2	93	1
Cooked, ⅔ c.:									
Spring	1	Tr.	3	16	.03	.03	.4	95	2
Winter	1	Tr.	4	20	.03	.02	.4	94	3
Chinese, 1 c.:									
Fresh	1	Tr.	2	12	.05	.05	1.0	96	1
9. **Cakes,** 1 serving:									
Angel	8	Tr.	60	272	...	...	....	31	Tr.
Chocolate	4	11	62	363	.02	.10	1.3	22	Tr.
Plain	5	13	58	369	.03	.05	.4	23	Tr.
Sponge	8	4	59	304	.03	.22	3.3	28	Tr.

* Addition of calcium optional.

Table 1 (*Continued*)

VITAMINS IN FOODS

(Calculated for 100 Gram Portions)

Foods (Full description on opposite page)	Vitamin A I.U.	Vitamin B Complex						Ascorbic Acid mg.	Vitamin D I.U.
		Thiamine mcg.	Riboflavin mcg.	Niacin mg.	Pantothenic Acid mcg.	Pyridoxine mcg.	Biotin mcg.		
1. Breads (*Continued*):									
White, plain	......	60	70	.7	460	20	1.1	0	
White, enriched	0	240	155	2.2	.....	...	.....	0	.
Whole wheat (graham)	0	280	150	3.5	570	38	1.9	0	
Zwieback	......	.	..		.....	.			
2. Broccoli, raw	3,500	90	210	.9	1,400	...	.....	118	.
Cooked	3,000	80	160	.....	.....	...	.....	9–28	.
3. Brussels sprouts, raw	400	110	60	.3	.....	...	.....	94	.
Cooked	400	.....	...	.....	.....	..	.....	...	
4. Buckwheat flour:									
Dark Light	0	610	160	4.2	.....	...	.....	0	.
Pancake	0	310	80	2.1	.....	...	.....	0	
5. Butter Summer	4,000	0	8	.1				0	35
Creamery	2,400								
6. Buttermilk:									
Genuine	0	35	155	.....	.....	...	.....	1	
Cultured	0	40	180	.1	.....	...	.....	1	
7. Butternuts		....	...	....		..	....	.	..
8. Cabbage:									
Fresh:									
Head	40	70	44	.3	180	120	2.4	52	
Outer leaves	880		100						
Cooked	170	32	...	...	.	.		10–35	.
Chinese:									
Fresh	2,000	66	38	.				40	
9. Cakes:									
Angel	......	9	120	.3					.
Chocolate	373	39	72	.3					
Plain	180	36	72	.4				.	
Sponge	640	72	165	.3					36

TABLE 1 (*Continued*)

PROXIMATE COMPOSITION OF FOODS

(Calculated for 100 Gram Portions)

Foods Approx. Measure of 100 Gm.	Protein Gm.	Fat Gm.	Carbohydrate Gm.	Calories	Minerals			Water Gm.	Fiber Gm.
					Ca Gm.	P Gm.	Fe mg.		
1. **Candies:**									
Butterscotch, 20 pc.	0	12	82	436	...	...	....	5	0
Caramels, 10 pc.	2	12	78	428	...	...	....	7	0
Chocolate (bitter and sweet). (*See* Chocolate.)									
Chocolate creams, 4 pc. 1″ diam.	2	4	88	396	.02	.10	.8	5	0
Fudge, plain, 8 pc.	4	14	72	430	...	...	....	9	0
Hard candy, 10 pc.	0	0	99	396	...	...	....	1	0
Peanut brittle, 4 pc.	12	18	67	478	.03	.16	.8	2	0
2. **Cantaloupe,** ⅓ med.	1	Tr.	5	24	.02	.02	.4	94	Tr.
3. **Carrots:**									
Raw, 1 lg.	1	Tr.	9	40	.04	.04	.8	89	1
Cooked, ½ c.	1	Tr.	8	36	.03	.03	.4	91	1
Canned, sieved, ½ c.	1	Tr.	7	32	.02	.02	.6	92	1
4. **Cashew nuts,** ¾ c.:									
Roasted	20	47	27	611	.05	.48	....	5	1
5. **Catchup, tomato,** ½ c.	2	Tr.	25	108	.01	.02	.8	70	Tr.
6. **Cauliflower,** ¼ sm. (1 c. cooked)	2	Tr.	5	28	.02	.07	1.1	92	1
7. **Celery,** ¾ c. cut:									
Bleached Green	1	Tr.	4	20	.05	.04	.5	99	1
8. **Chard,** leaves, 2¼ c. (½ c. cooked)	1	Tr.	4	20	*	.04	4.0	92	1
9. **Cheese:**									
Cheddar, American, 2″ x 2″ x 1¼″	24	32	2	392	.87	.61	.6	39	0
Cottage (from skim milk), 5 tbsp.	19	1	4	101	.08	.26	.5	74	0
Cream (Neufchâtel type), 6 tbsp.	7	37	2	369	.30	.21	.2	53	0
Roquefort, 3″ x 3″ x 1″	22	33	1	389	.72	.52	1.0	40	0
Swiss (*also* Gruyère), 4″ x 4″ x ⅝″	29	31	2	403	1.0	.85	1.2	35	0

* Ca .11 mg.; may not be available because of the presence of oxalic acid.

TABLE 1 (*Continued*)

VITAMINS IN FOODS

(Calculated for 100 Gram Portions)

Foods (Full description on opposite page)	Vitamin A I.U.	Vitamin B Complex						Ascorbic Acid mg.	Vitamin D I.U.
		Thiamine mcg.	Riboflavin mcg.	Niacin mg.	Pantothenic Acid mcg.	Pyridoxine mcg.	Biotin mcg.		
1. Candies:									
Butterscotch	......	.....	...	.....	.....	...	.....	...	
Caramels	....	..	.	....	.....	...	.....	...	.
Chocolate creams	.....	.....	...	...	.....	...	... .	..	.
Fudge, plain	180	15	39	.....	.....	...	.....	...	
Hard candy	....	.....	...	....	.....	...	.....	.	.
Peanut brittle	144	150	80	5.0	.....	...	.....	...	...
2. Cantaloupe	3,400	60	40	.8	230	36	3.1	33	. .
3. Carrots:									
Raw	12,000	70	60	.5	250	120	2.5	6	
Cooked	10,000	60	...	.....	.....	...	.....	...	
Canned	10,000	30	20	.3	110	...	.....	2	
4. Cashew nuts:									
Roasted	. ..	150	190	...	.....	. .	....	.	
5. Catchup, tomato	1,880	90	70	2.2	.....	...	.....	11	
6. Cauliflower, raw	90	100	110	.6	920	20	17.0	69	.
Cooked	......	50	...	.5	.....	...	.....	12	.
7. Celery:									
Bleached	0	35	40	.3	.....	...	.....	7	.
Green	1,000								
8. Chard, leaves, raw	2,800	60	130	.2	.....	...	.....	38	
Cooked	......	.....	...	.....	.....	...	.....	15	
9. Cheese:									
Cheddar	1,740	45	500	.2	180	66	1.7	0	33
Cottage	30	20	300	.1	.....	...	.....	0	
Cream	2,200	10	140	.1	140	...	1.2	0	
Roquefort	4,010	30	450	1.2	960	...	7.6	0	
Swiss	2,000	30	400	.1	260	...	1.1	0	

TABLE 1 (*Continued*)

PROXIMATE COMPOSITION OF FOODS

(Calculated for 100 Gram Portions)

Foods Approx. Measure of 100 Gm.	Protein Gm.	Fat Gm.	Carbohydrate Gm.	Calories	Minerals			Water Gm.	Fiber Gm.
					Ca Gm.	P Gm.	Fe mg.		
1. **Cherries:**									
Fresh:									
Sour, ⅔ c.	1	1	13	65	.02	.03	.4	84	Tr.
Sweet, 15 lg.	1	1	18	85	.02	.03	.8	79	Tr.
Canned, ⅔ c.:									
Water pack, red and white	1	Tr.	10	44	.01	.02	.3	88	Tr.
Juice pack, red and white	1	Tr.	13	56	...	...	....	85	Tr.
In sirup, red, pitted	1	Tr.	29	120	.01	.01	.3	69	Tr.
2. **Chestnuts,** 15–18 nuts:									
Fresh	3	2	42	198	.03	.09	.7	52	1
Dried	7	4	79	380	...	...	4.1	9	3
3. **Chicken:**									
Fresh:									
Squab, 1 med.	22	3	0	115	.01	.20	2.8	74	
Broiler or fryer (flesh only), ½ med.	21	5	0	129	.01	.20	2.8	73	..
Roasters, ½ breast (total E.P.)	20	13	0	197	.02	.22	1.9	66	
Roasters (flesh only) 1 thigh	21	5	0	129	.02	.29	4.1	73	
Gizzard, 2–3	23	4	1	132	...	...	....	72	.
Liver (*See* Liver)									
Canned:									
Meat only	22	10	0	178	.03	.22	1.9	67	
Cooked (*See* Meat & Poultry cooked)									
4. **Chicory** (*See* Curly Endive)									
5. **Chili sauce,** ½ c.	3	Tr.	24	108	...	...	....	72	1
6. **Chives,** ¾ c. cut	4	1	8	57	.05	.06	2.5	86	2
7. **Chocolate,** 3½ squares or a piece 2¼′ x 5′ x ½″:									
Bitter or unsweetened	6	53	(18)	573	.10	.34	2.5	2	3
Bitter sweet	3	30	60	522	.08	.40	2.2	2	1
Sweet milk	6	34	54	546	.09	.45	2.0	2	1

TABLE 1 (*Continued*)

VITAMINS IN FOODS

(Calculated for 100 Gram Portions)

Foods (Full description on opposite page)	Vitamin A I.U.	Vitamin B Complex						Ascorbic Acid mg.	Vitamin D I.U.
		Thiamine mcg.	Riboflavin mcg.	Niacin mg.	Pantothenic Acid mcg.	Pyridoxine mcg.	Biotin mcg.		
1. Cherries:									
Fresh:									
Sour	1,300	45	60	.1	.....	...	.....	8	..
Sweet	15–550								
Canned:									
Water pack	......	.....	...	.....	.....	...	.....	.	.
Juice pack					..	..	.	.	..
In sirup	870	30	20	.2	120	...	.....	3	..
2. Chestnuts:									
Fresh	80	228	...	1.2	.....	...	.....	40	
Dried	......	.....	...	.....	.....	...	.....		
3. Chicken:									
Fresh:									
Squab							.	..	..
Broiler or fryer	......	.....	...	.....	.....	...	.....	..	..
Roasters, raw:									
Dark	5	240	260	6.5	1,200	25	10.1	4	..
Light	5	160	90	7.2	600	130	11.3	4	...
Roasted:									
Dark	......	173	240	6.2	.....	...	.....		
Light	......	112	67	6.7	.....	...	.....		.
Gizzard	......	.....	...	.....	.....	...	.....		
Canned	5	10	160	4.8	.....	..	.....	2	
4. Chicory									
5. Chili sauce	......	.....	...	.....	.....	...	.....		
6. Chives	......	.....	...	.....	.....	...	.....	54	
7. Chocolate:									
Bitter	0	.....	240	1.1	190	23	32.0	0	
Bitter sweet				[illegible]	[illegible]	[illegible]	[illegible]		.
Sweet milk	......	.....	...	.....	.....	...	.....		.

TABLE 1 (*Continued*)

PROXIMATE COMPOSITION OF FOODS

(Calculated for 100 Gram Portions)

Foods Approx. Measure of 100 Gm.	Pro-tein Gm.	Fat Gm.	Carbo-hydrate Gm.	Calo-ries	Minerals			Water Gm.	Fiber Gm.
					Ca Gm.	P Gm.	Fe mg.		
1. Chocolate malted milk (*See* Beverages)									
2. Cider (*See* Apple juice)									
3. Clams, 6 med.:									
Raw:									
Long (meat only).	14	2	2	82	.11	.10	4.2	80	. .
Round (meat only)	11	1	6	77	.11	.09	4.4	80	. .
4. Cocoa, ¾ c.:									
Dry powder........	9	19	31	331	*	.71	2.7	4	5
Beverage (*See* Beverages)									
5. Coconut, 1⅛ c.:									
Fresh (grated)......	4	36	17	408	.06	.16	2.7	42	4
Canned or packaged:									
Moist (shredded).	4	29	50	477	. . .	. . .	. . . .	16	4
Dry (shredded)...	4	39	53	579	.04	.19	3.6	3	4
6. Collards, leaves, 2 c.... (½ c. cooked)	4	1	7	53	.25	.06	1.6	87	1
7. Cookies:									
Crisp, thin, rich, 7 2¾″ diam......	8	18	70	474	. . .	. . .	. . . .	3	Tr.
Ginger snaps, 20 1¾″ diam.....	6	9	77	413	. . .	. . .	. . . .	6	Tr.
Peanut, 7 2″ diam...	14	28	54	524	. . .	. . .	. . . .	3	1
Soft, thick, 4 3″ diam..........	7	11	73	419	.02	.07	.6	7	Tr.
8. Corn:									
Popcorn, popped, 6 c.	11	5	78	401	.02	. . .	1.9	4	2
Sweet:									
Fresh, 1 ear:									
Young.........	3	1	15	81	. . .	. . .	. . . .	80	1
Medium.......	4	1	22	113	.01	.10	.5	72	1
Old...........	6	2	27	150	. . .	. . .	. . . .	64	1
Canned, ½ c.....	2	1	16	81	.01	.10	.5	80	Tr.
9. Corn bread (2 pc. 2″ square)....	8	6	45	266	.07	.13	1.3	. .	Tr
10. Cornflakes, 6 c........	8	1	80	361	.10	.06	1.0	9	1

* Ca 16 mg.; may not be available because of the presence of oxalic acid.

TABLE 1 (*Continued*)

VITAMINS IN FOODS

(Calculated for 100 Gram Portions)

Foods Full description on opposite page	Vitamin A I.U.	Vitamin B Complex						Ascorbic Acid mg.	Vitamin D I.U.
		Thiamine mcg.	Riboflavin mcg.	Niacin mg.	Pantothenic Acid mcg.	Pyridoxine mcg.	Biotin mcg.		
1. Chocolate malted milk									
2. Cider									
3. Clams:									
Fresh:									
Long..........	20	33	20	1.1	.....	...	.....	6	5
Round.........									
4. Cocoa:									
Dry powder.......	0	.....	390	2.3	.....	...	.....	0	
5. Coconut:									
Fresh............	......	80	100	.4	.....	...	.....	7	
Canned or pkg.:									
Moist..........	......	120	105	.4	.....	...	.....	...	
Dry............	......	150	126	.4	.....	...	.....	0	
6. Collards, raw........	6,870	220	200	.8	.....	...	.....	100	
Cooked	10,000	123					..	23	
7. Cookies:									
Crisp, rich...							...		
Ginger snaps									
Peanut...........	60	180	129	3.9	.....	...	.....		
Soft, thick........	170	40	60	.5	.....	...	.....		
8. Corn:									
Popcorn, popped...	500	.....	...	2.0	.....	...	.....	0	
Sweet:									
Fresh:									
Young:									
White......	0	123	121	...	800	...	.....	12	
Yellow.....	390	155	140	1.4					
Canned:									
White........	0	20	50	1.0	210	...	.....	2	
Yellow.......	200	20	52	.9	200	...	.....	5	
9. Corn bread.........	300	151	218	1.6	.....	...	.....	0	
10. Cornflakes.........	1,500	380*	90	1.6*	.....	...	.....	0	

* Restored by addition of vitamins.

TABLE 1 (*Continued*)

PROXIMATE COMPOSITION OF FOODS

(Calculated for 100 Gram Portions)

Foods Approx. Measure of 100 Gm.	Protein Gm.	Fat Gm.	Carbohydrate Gm.	Calories	Minerals			Water Gm.	Fiber Gm.
					Ca Gm.	P Gm.	Fe mg.		
1. Corn meal:									
Whole ground white or yellow, ⅔ c....	9	4	74	368	.02	.26	2.7	12	2
Bolted, degerminated:									
White, ⅔ c.......	8	1	79	357	.01	.14	1.0	12	1
Yellow, ⅔ c......	8	1	78	353	.01	.14	1.0	12	1
Gruel, ½ c.........	1	Tr.	4	20	...	...	....	95	Tr.
Mush, ⅓ c.........	1	1	11	57	.01	.04	.1	87	1
2. Corn sirup (*See* Sirups)									
3. Cornstarch:									
Dry, ⅔ c...........	1	Tr.	87	352	0	0	0	12	.
Pudding (*See* Puddings)									
4. Cowpeas, dry.........	23	1	62	349	.08	.45	7.8	11	..
5. Crabapples, 3 apples...	Tr.	Tr.	18	72	...	...	....	81	1
6. Crabs, hard-shell, ⅔ c.:									
Raw or cooked.....	16	2	1	86	.02	.18	1.0	80	
Canned (American).	17	3	1	99	.02	.18	.9	78	..
7. Crackers:									
Fat, rich, 22........	9	18	69	474	.01	.06	.6	2	Tr.
Graham, 10........	8	10	74	418	.02	.20	1.9	6	1
Saltines, 12........	9	12	71	428	.02	.16	1.5	6	Tr.
Soda, 16...........	10	10	73	422	.02	.10	1.5	5	Tr.
8. Cranberries:									
Fresh, 1 c..........	Tr.	1	11	53	.02	.01	.4	87	1
Canned, sauce, ½ c.	Tr.	Tr.	51	204	.01	.01	.3	48	Tr.
9. Cream, ½ c.:									
Thin or coffee (20%)	3	20	4	208	.10	.08	.1	73	0
Heavy or whipping..	2	35	3	335	.09	.07	.2	60	0
10. Cream sauce (*See* White sauce)									
11. Cucumber, 1 med.....	1	Tr.	3	16	.01	.02	.3	96	Tr.
12. Currants, red, white, and black:									
Fresh, 1 c..........	2	Tr.	13	60	.06	.05	.6	84	3

TABLE 1 (*Continued*)

VITAMINS IN FOODS

(Calculated for 100 Gram Portions)

Foods (Full description on opposite page)	Vitamin A I.U.	Vitamin B Complex						Ascorbic Acid mg.	Vitamin D I.U.
		Thiamine mcg.	Riboflavin mcg.	Niacin mg.	Pantothenic Acid mcg.	Pyridoxine mcg.	Biotin mcg.		
1. Corn meal:									
Whole ground:									
White	0	410	120	1.7	310	54	5.8	0	
Yellow	510	450	170	2.1	.....	...	.....	0	
Bolted:									
White	0	160	90	.9	.....	...	.....	0	
Yellow	300	150	60	.9	.....	...	.....	0	
Gruel	......	.....	...	.....	.....	...	.....	0	
Mush	118	30	58	.....	.....	...	.....	0	
2. Corn sirup									
3. Cornstarch:									
Dry	0	0	0	0	0	0	0	0	0
4. Cowpeas, dry	0	830	230	2.2	.....	...	.....	2	
5. Crabapples	......	.....	...	.....	.....	...	.....	..	...
6. Crabs, hard-shell:									
Raw or cooked	......	120	350	2.8	.....	...	.....	0–12	...
Canned (American)	......	230	150	.....	.....	...	.....	...	...
7. Crackers:									
Fat, rich								0	
Graham	......	300	120	1.5	.....	...	.....	0	...
Saltines	......	.....	...	.....	.....	...	.....	0	...
Soda	......	70	50	.6	.....	...	.....	0	...
8. Cranberries:									
Fresh	40	30	...	.1	.....	...	.....	12	...
Canned, sauce	30	.....	40	.....	.....	...	.....	2	...
9. Cream:									
Thin	830	30	140	.1	.....		.....	1	13
Heavy	1,600	25	125	.....	.....	...	.....		13
10. Cream sauce									
11. Cucumber	0	40	90	.2				8	
12. Currants:									
Fresh:									
Black	400	45		.....	.....	.		225	
Red		45	135	.....	.....	.		35	

TABLE 1 (*Continued*)

PROXIMATE COMPOSITION OF FOODS

(Calculated for 100 Gram Portions)

Foods Approx. Measure of 100 Gm.	Protein Gm.	Fat Gm.	Carbohydrate Gm.	Calories	Minerals			Water Gm.	Fiber Gm.
					Ca Gm.	P Gm.	Fe mg.		
1. **“Currants,”** dried, ½ c.	2	1	71	301	.08	.20	4.0	..	2
2. **Custard,** ½ c.:									
Baked or boiled	6	6	16	142	.12	.13	.8	..	0
3. **Dandelion greens,** 2¼ c. raw, (½ c. cooked)	3	1	9	57	.19	.07	3.1	86	2
4. **Dasheens,** tubers, 1–2	3	Tr.	29	128	...	...	....	67	1
5. **Dates:**									
“Fresh” and dried, 14	2	1	75	317	.07	.06	3.5	11	2
6. **Dock or sorrel,** leaves and stems, 2¼ c.	2	Tr.	3	20	...	...	2.8	94	1
7. **Doughnuts,** 2 sm.	7	21	53	429	.07	.14	1.0	18	Tr.
8. **Duck,** domesticated, ¼ lb. A.P.:									
Flesh, skin, giblets and fat	16	29	0	325	.01	.26	2.7	54	0
Flesh only	21	8.	0	156	.01	.24	3.3	70	0
9. **Duck,** wild, ¼ lb. A.P.:									
Flesh, skin, giblets	21	16	0	228	...	...	....	62	0
Flesh only	21	5	0	129	.01	.24	3.3	73	0
10. **Eels,** American, ¼ lb. A.P.:									
Raw	19	9	0	157	.02	.21	1.0	71	0
Smoked	19	28	0	328	...	...	....	52	0
11. **Eggplant,** 2 slices ⅜″ thick	1	Tr.	6	28	.02	.04	.4	93	1
12. **Eggs:**									
Raw:									
Whole, 2	13	12	1	164	.05	.21	2.7	74	0
White, 3½	11	0	1	48	.02	.01	.1	89	0
Yolk, 7	16	32	1	356	.15	.59	7.2	49	0
13. **Eggnog** (*See* Beverage)									
14. **Endive,** curly, 30–40 leaves	2	Tr.	4	24	.08	.04	2.0	93	1

TABLE 1 (*Continued*)

VITAMINS IN FOODS

(Calculated for 100 Gram Portions)

Foods (Full description on opposite page)	Vitamin A I.U.	Vitamin B Complex						Ascorbic Acid mg.	Vitamin D I.U.
		Thiamine mcg.	Riboflavin mcg.	Niacin mg.	Pantothenic Acid mcg.	Pyridoxine mcg.	Biotin mcg.		
1. **"Currants,"** dried									
2. **Custard:**									
Baked or boiled....	500	125	312	.1	.....	...	.....	...	20
3. **Dandelion greens**....	13,650	190	140	.8	.....	...	.....	36	.
4. **Dasheens,** tubers....	......	.....	...	.....	.....	...	.....		
5. **Dates:**									
"Fresh" and dried.	165	72	45	2.2	.....	...	.....		.
6. **Dock or sorrel,** leaves............	15,000	75	...	.....	.....	...	.....	113	.
7. **Doughnuts**..........	200	75	150	1.6	.....	...	....	0	
8. **Duck,** domesticated:									
Flesh, etc.........	......	160	230	6.1	.....	...	.....		.
Flesh only		...		....	.....	.	....		.
9. **Duck,** wild:									
Flesh, etc.							..		
Flesh only........	......	.....	...	.....	.....	...	.....		
10. **Eels,** American:									
Raw e.p...........	......	144	72	.....	.....	...	.....		
Smoked............	......	.....	...	.....	.....	...	.....		
11. **Eggplant**............	30	70	60	.8	.....	...	.....		
12. **Eggs:**									
Raw:									
Whole..........	1,140	120	340	.1	1,400	22	9.0	0	15
White..........	0	.....	200	.1	.....	...	.....	0	...
Yolk...........	3,210	320	520	.....	5,000	...	.....	0	320
13. **Eggnog**									
14. **Endive**............	3,850	100	200	.4	.....	...	.....	13	

TABLE 1 (*Continued*)

PROXIMATE COMPOSITION OF FOODS

(Calculated for 100 Gram Portions)

Foods Approx. Measure of 100 Gm.	Protein Gm.	Fat Gm.	Carbohydrate Gm.	Calories	Minerals			Water Gm.	Fiber Gm.
					Ca Gm.	P Gm.	Fe mg.		
1. Escarole									
4 large leaves.......	2	Tr.	3	20	.07	.04	1.8	94	1
2. Farina, ½ c.:									
Dry, ½ c..........	12	1	76	361	.02*	.13	.8*	..	Tr.
Cooked, ½ c.......	3	Tr.	20	92	.01*	.03	.2*	11	Tr.
3. Fats, cooking, ½ c.:									
Vegetable or animal	0	100	0	900	0	0	0	0	0
4. Figs:									
Fresh, 2 med.......	1	Tr.	20	84	.05	.04	.8	78	2
Dried, 8 med.......	4	1	68	297	.16	.12	2.9	..	6
Pressed, Smyrna....	3	Tr.	63	264	...	...	....	..	6
5. Fig bars, ¼ lb........	4	5	76	365	.07	.07	1.3	14	2
6. Filberts, ⅔ c.........	15	66	14	710	.29	.35	4.5	4	5
7. Fish, ¼ lb. A.P.:									
Raw or preserved:									
Bass, black.......	21	2	0	102	...	...	....	76	0
Blue or Tailor....	21	4	0	120	.02	.24	.6	74	0
Bonito...........	24	7	0	159	...	...	....	68	0
Carp............	18	2	0	90	...	...	....	79	0
Cod:									
Raw..........	17	Tr.	0	68	.02	.19	.9	83	0
Dried..........	82	3	0	355	.28	.29	.5	13	0
Flounder, "sole," 1 fillet.......	15	1	0	69	.02	.16	.8	83	0
Haddock:									
Raw..........	17	Tr.	0	68	.04	.20	.9	82	0
Smoked or Finnan Haddie..	23	Tr.	0	92	.02	.25	1.2	76	0
Halibut, steak....	19	5	0	121	.02	.21	1.0	75	0
Herring:									
Raw, Atlantic..	19	7	0	139	.02	.22	1.1	73	0
Kippered, 1 sm.	22	13	0	205	.04	.42	2.0	64	0
Smoked........	37	16	0	292	.04	.42	2.0	46	0
Mackerel:									
Raw (common Atlantic).....	19	12	0	184	.02	.22	1.0	68	0
Salt...........	19	25	0	301	.03	.32	1.5	55	0
Pike............	19	1	0	85	...	...	....	79	0

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* Fortified cereals may contain these amounts of calcium and iron.

TABLE 1 (*Continued*)

VITAMINS IN FOODS

(Calculated for 100 Gram Portions)

Foods Full description on opposite page	Vitamin A I.U.	Vitamin B Complex						Ascorbic Acid mg.	Vitamin D I.U.
		Thiamine mcg.	Riboflavin mcg.	Niacin mg.	Pantothenic Acid mcg.	Pyridoxine mcg.	Biotin mcg.		
1. Escarole	15,000	110	250	.4	.....	...	.....	7	.....
2. Farina: Dry, plain	0	60	60	1.0	.....	...	.....	0	.....
Restored	0	370*	260*	1.3*	.....	...	.....	0	.....
3. Fats, cooking:									
Vegetable or animal (Lard)	4	0	0	0	0	0	0	0	0
4. Figs:									
Fresh	60	90	85	.6	.....	...	.....	2	.....
Dried	75	130	105	1.7	.....	...	.....	0	.....
Pressed, Smyrna	.		...			...			...
5. Fig bars	0	20	60	.9	.....	...	.....	0	.....
6. Filberts	270	400						15	
7. Fish:									
Raw or preserved:									
Bass	......	.....	...	.....	.....	...	.....	...	.....
Blue or Tailor	......	.....	200	.....	.....	...	.....	...	.....
Bonito									
Carp			36						
Cod:									
Raw	10	40	50	2.3	.....	...	5.0	2	.....
Dried	......	.....	...	.....	.....	...	.....	0	.....
Flounder, "sole"	......	70	195	3.8	.....	...	.....	...	.....
Haddock:									
Raw	7	90	120	.9	.....	...	.....	...	.....
Cooked	7	80	105						
Smoked	6	100	110	.6	.....	...	.....	...	.....
Halibut, steak	12	90	65	3.0	150	110	8.0	...	17
Herring:									
Raw, Atlantic	140	100	360	3.5	.....	...	.....	...	1,500
Kippered	......	...	190						
Smoked	60	49	160	2.1	.....	...	.....	0	1,140
Mackerel:									
Raw	175	100	640	6.3	.....	...	.....	...	1,100
Cooked	175	73	600						
Canned		34	200	7.8	290				
Pike									

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* Restored by addition of vitamins. For 100 Gm. cooked cereal calculate $^1/_4$ the vitamin in 100 Gm. dry.

Table 1 (*Continued*)

PROXIMATE COMPOSITION OF FOODS

(Calculated for 100 Gram Portions)

Foods Approx. Measure of 100 Gm.	Protein Gm.	Fat Gm.	Carbohydrate Gm.	Calories	Minerals			Water Gm.	Fiber Gm.
					Ca Gm.	P Gm.	Fe mg.		
1. **Fish** (*Continued*):									
Salmon:									
Raw:									
Atlantic	23	13	0	209	.02	.25	1.0	63	0
Chinook or King	17	17	0	221	...	...	....	65	0
Canned, average, 1 c. scant	21	10	0	174	.07	.29	1.3	67	0
Sardines, with oil:									
Drained solids, 11 3″ long	26	11	1	207	.04	.37	1.8	57	
Shad	19	10	0	166	.02	.22	1.0	70	0
Shad roe, ½ med.	21	4	0	120	.02	.24	1.2	74	0
Trout, brook	19	2	0	94	.02	.20	1.0	78	0
Tuna, canned with or without added oil, ¾ c. scant	28	12	0	220	.03	.29	1.7	58	0
White, Great Lakes, ¼ lb. A.P.	23	7	0	155	.03	.26	1.3	69	0
Cooked, all kinds:									
Boiled or steamed:									
Lean or medium fat	21	2	0	102	...	...	....		.
Fat	22	11	0	187	...	...	....		
Baked or broiled	24	13	0	213	...	...	....		.
Fried in meal, flour or batter	20	12	0	218	...	...			
2. **Flour** (*See* Buckwheat, Rice, Rye, Wheat, etc.)									
Pancake, ¾ c.:									
Self-rising, mixed	10	2	72	346	.24	...	.8	12	1
3. **Frog legs**, ¼ lb. A.P.	16	Tr.	0	64	...	...	....	..	0
4. **Fruit cocktail**, canned	Tr.	Tr.	19	76	.01	.01	.4	81	Tr.
5. **Garbanzos or chick peas**:									
Dry seeds, ½ c.	21	5	61	373	.09	.38	7.1	11	5
6. **Garlic**, bulbs, 50 cloves, peeled	4	Tr.	20	96	.01	.14	2.3	75	1
7. **Gelatin**:									
Plain dry, 10 tbsp.	86	Tr.	0	344	...	...	....	..	0

Table 1 (*Continued*)

VITAMINS IN FOODS

(Calculated for 100 Gram Portions)

Foods (Full description on opposite page)	Vitamin A I.U.	Vitamin B Complex						Ascorbic Acid mg.	Vitamin D I.U.
		Thiamine mcg.	Riboflavin mcg.	Niacin mg.	Pantothenic Acid mcg.	Pyridoxine mcg.	Biotin mcg.		
1. **Fish** (*Continued*):									
Salmon:									
Raw:									
Atlantic...	290	210	140	7.4	660	33	5.3	9	400
Chinook...									
Canned, average, Pink.	80	30	180	6.5	570	...	.....	0	700
Red........	800								
Sardines........	290	60	120	5.2	260	...	.....	0	1,200
Shad...........	125	90	150	.....	.....	...	...	...	....
Shad roe........	2,500	250	100	2.4	....	...	...	5	.....
Trout, brook....	12	87	50	3.5	.....	...	...	...	.....
Tuna, canned...	130	40	130	10.6	..170	...	.....	0	.....
White, Great Lakes........	12	90	...	.....	.....	.	.	.	...
Cooked, all kinds:									
Boiled or steamed:									
Lean or medium...	(For vitamin figures) (*See* Haddock, cooked)								
Fat..........	(*See* Mackerel, cooked)								
Baked or broiled	......	.....	...	.....	..		.	..	.
Fried..........	......	.....	...	.....				..	.
2. **Flour**:									
Pancake:									
Self-rising, mixed	......	80	40	.9	...	.	..	0	...
3. **Frog legs**...	....		...	.....	.....	..			
4. **Fruit cocktail**........	160	10	10	.4					
5. **Garbanzos**:									
Dry seeds.........	......	350	150	1.4	...	...	...	..	...
6. **Garlic, bulbs**...				..		..	..	32	
7. **Gelatin**:									
Plain dry........	......	.....	...	.....	.....				

TABLE 1 (*Continued*)

PROXIMATE COMPOSITION OF FOODS

(Calculated for 100 Gram Portions)

Foods Approx. Measure of 100 Gm.	Protein Gm.	Fat Gm.	Carbohydrate Gm.	Calories	Minerals			Water Gm	Fiber Gm.
					Ca Gm.	P Gm.	Fe mg.		
1. **Ginger,** candied, 12 pcs.	Tr.	Tr.	87	348	...	..			
2. **Ginger ale** (*See* Beverages)									
3. **Gingerbread,** 2 pieces (with enriched flour)	4	12	51	328	.04	.02	3.6	..	Tr.
4. **Gluten flour,** ¾ c.....	41	2	47	370	...	...	....	10	Tr.
5. **Goose,** domesticated, ¼ lb. A.P.:									
Flesh, skin and giblets...........	16	32	0	352	...	...	....	51	...
Flesh only.........	22	7	0	151	.01	.18	2.0	70	...
6. **Gooseberries, 1 c.**.....	1	Tr.	10	44	.04	.05	.05	88	3
7. **Grapefruit:**									
Fresh, ½ med......	1	Tr.	10	44	.02	.02	.3	89	Tr.
Canned in juice:									
Unsweetened, ½ c.	1	Tr.	9	40	.01	.01	.3	90	Tr.
Sweetened, ½ c...	1	Tr.	19	80	.01	.01	.3	80	Tr.
8. **Grapefruit juice,** canned, ½ c.:									
Unsweetened.......	Tr.	Tr.	11	44	.01	.01	.4	89	0
Sweetened.........	Tr.	Tr.	16	64	.01	.01	.4	84	0
9. **Grapes,** 24 or ½ c.:									
American type: (24 grapes)									
Concord, Delaware, Niagara, Scuppernong...	1	1	15	73	.02	.03	.7	82	1
European type: (20 grapes)									
Malaga, Muscat, Tokay, Thompson seedless, ¼ lb............	1	Tr.	17	72	.02	.02	.6	82	1
10. **Grape juice,** ½ c.:									
Fresh or bottled....	Tr.	0	19	76	.01	.01	.3	80	0
11. **Guava,** common, 1 pared, seeded.....	1	1	17	81	.02	.02	.3	80	6

TABLE 1 (*Continued*)

VITAMINS IN FOODS

(Calculated for 100 Gram Portions)

Foods (Full description on opposite page)	Vitamin A I.U.	Vitamin B Complex						Ascorbic Acid mg.	Vitamin D I.U.
		Thiamine mcg.	Riboflavin mcg.	Niacin mg.	Pantothenic Acid mcg.	Pyridoxine mcg.	Biotin mcg.		
1. **Ginger**, candied	...		...				...		...
2. **Ginger ale**									
3. **Gingerbread**	94	181	185	1.3	.....	...	.....	...	...
4. **Gluten flour**	...	....		...	...	...	...	...	...
5. **Goose:**									
Flesh only:									
Raw	...	...		...	...		...	...	...
Roasted	.....	170	230	6.2	.....	...	.....	...	...
6. **Gooseberries**	380	150	...	.....	.....	...	.....	35	...
7. **Grapefruit:**									
Fresh	21	40	20	.2	290	9	3.0	40	...
Canned in juice:									
Unsweetened Sweetened	15	30	20	.2	160	...	.....	30	...
8. **Grapefruit juice:**									
Unsweetened Sweetened	10	30	20	.2	170	...	.....	35	...
9. **Grapes:**									
American type	40	45	60	.3	.....	...	.....	3	...
European type	80	50	30	.4	.....	...	.....	4	
10. **Grape juice:**									
Fresh or bottled	24	10	10	.....	.....	...	.....	2	
11. **Guava**, common	200	45	80	1.1	.....	...	.....	80	

TABLE 1 (*Continued*)

PROXIMATE COMPOSITION OF FOODS

(Calculated for 100 Gram Portions)

Foods Approx. Measure of 100 Gm.	Protein Gm.	Fat Gm.	Carbohydrate Gm.	Calories	Minerals			Water Gm.	Fiber Gm
					Ca Gm.	P Gm.	Fe mg.		
1. **Guinea hen,** ¼ lb. A.P.: Flesh, skin and giblets	23	6	0	146	...	...	....	70	0
2. **Ham** (*See* Pork, Cured)									
3. **Hazelnuts,** ⅔ c.	15	66	14	710	.29	.35	4.5	4	5
4. **Heart:**									
Beef, ½ med.	17	6	1	126	.01	.24	6.2	75	...
Pork, 1 med.	17	5	Tr.	113	...	...	....	77	..
5. **Hickory nuts,** ⅔ c.	14	67	13	711	...	...	2.4	5	2
6. **Hominy (or grits),** ½ c.:									
Dry	9	1	79	361	.01	.07	1.0	11	Tr.
Cooked or canned	2	Tr.	15	68	0	.02	.1	82	Tr.
7. **Honey,** strained, 5 tbsp.	Tr.	0	80	320	0	.02	.9	20	0
8. **Honeydew,** casaba melon, ¾ c., flesh	1	Tr.	8	36	...	...	....	90	1
9. **Huckleberries** (*See* Blueberries)									
10. **Ice cream and frozen desserts,** ⅙ qt.:									
Ice cream, ½ cup:									
Plain	4	12	21	208	.13	.10	.1	62	0
Rich	4	23	18	295	.08	.08	.2	53	0
Ices (fruit juice, sugar, and water)	Tr.	...	27	108	...	...	....	73	0
Frozen custard	4	9	18	169	.14	.13	.8	68	0
Sherbert, ⅛ qt.	2	3	25	135	.07	.04	.1	70	0
11. **Jams,** commercial, ⅓ c.	1	Tr.	71	288	.01	.01	.3	28	1
12. **Jellies,** fruit, ⅓ c.	Tr.	0	65	260	.01	.01	.3	35	0
13. **Kale,** leaves, 2 c. packed, ½ cooked	4	1	7	53	.22	.06	2.2	87	1
14. **Kidney, beef,** ¼ lb. A.P.	17	8	1	144	.02	.28	5.6	73	0
15. **Kohlrabi,** ½ c. diced	2	Tr.	7	36	.08	.07	.6	90	1

TABLE 1 (*Continued*)

VITAMINS IN FOODS

(Calculated for 100 Gram Portions)

Foods (Full description on opposite page)	Vitamin A I.U.	Vitamin B Complex						Ascorbic Acid mg.	Vitamin D I.U.
		Thiamine mcg.	Riboflavin mcg.	Niacin mg.	Pantothenic Acid mcg.	Pyridoxine mcg.	Biotin mcg.		
1. Guinea hen:									
Flesh, etc.	.....	.....	.....	.....	.....	...	.....	...	...
2. Ham									
3. Hazelnuts	270	400	.....	.....	.....	...	...	15	
4. Heart:									
Beef, raw	41	540	900	6.8	2,000	240	8.1	14	..
Cooked	.....	350	900	6.3	.....	150	.....	1	.
Pork	.....	610	1,120	6.5	2,050	350	15.0	4	
5. Hickory nuts	.....	540	.....	.....	.....	...	.....	...	.
6. Hominy (or grits):									
Dry	....	150	50	.9	100	5	.6	0	..
Cooked	.....	0	10	.....	.....	...	.	0	
7. Honey, strained	....	10	40	.2	150	299	....	4	
8. Honeydew, casaba	10	46	.....	.3	.....	...	.....	94	.
9. Huckleberries									
10. Ice cream and frozen desserts:									
Ice cream:									
Plain	540	40	190	.1	.....	.		1	
Rich	900								
Ices	.....	...	....		....	..		6	
Frozen custard	750	70	250	.....	.....	.	.		
Sherbert	12	...	....	....	...	..		7	
11. Jams, commercial	10	20	20	.2	.....	.		6	
12. Jellies, fruit	10	20	20	.2	.....	...	...	4	
13. Kale, leaves, raw	8,540	120	350	.8	300	...	...	115	
Cooked	......	.....	....	....	....	.	...	50	..
14. Kidney, beef, raw	940	320	2,000	.....	3,700	400	92	11	
Cooked	......	230	1,900	7.1	2,700	280	...	7	
15. Kohlrabi, raw	10,000	55	.....	.27	....	...	....	60	
Cooked	..	45	80	.....	.....	...	...	8–35	

Table 1 (*Continued*)

PROXIMATE COMPOSITION OF FOODS

(Calculated for 100 Gram Portions)

Foods Approx. Measure of 100 Gm.	Protein Gm.	Fat Gm.	Carbohydrate Gm.	Calories	Minerals			Water Gm.	Fiber Gm
					Ca Gm.	P Gm.	Fe mg.		
1. **Kumquats,** 3	1	Tr.	17	72	...	...	.5	81	4
2. **Lamb,** 3½ oz. raw: (*See* Meat, Cooked for average composition after cooking.)									
Chops, 1 med. chop:									
Rib	15	32	0	348	.01	.16	2.2	52	0
Shoulder	16	25	0	289	.01	.17	2.3	58	0
Patties, 2 med.	14	34	0	362	.01	.15	2.0	51	0
Roasts, med. serving:									
Leg	18	18	0	234	.01	.19	2.7	63	0
Shoulder	16	25	0	289	.01	.17	2.3	58	0
Stew meat (breast)	13	36	0	376	.01	.14	1.9	50	0
3. **Lard** (*See* Fats)									
4. **Leeks,** 1 c. or 3, 5″ long	3	Tr.	8	44	.06	.06	.7	88	1
5. **Lemon juice,** ½ c.	0	0	8	32	.01	.01	.1	91	0
6. **Lemonade,** ½ cup	0	0	12	48	0	0	0	88	0
7. **Lentils,** dry, ½ c.	25	1	60	349	.11	.44	8.6	12	3
8. **Lettuce,** ⅓ head:									
Inner leaves	1	Tr.	3	16	.02	.03	.5	95	1
Outer leaves, 6 large	1	Tr.	2	12	.02	.03	.5	96	1
9. **Limes,** fresh	1	Tr.	12	52	.01	.01	.1	86	..
10. **Liver,** ¼ lb. A.P.:									
Beef	20	3	6	131	.01	.37	12.0	70	0
Calf	19	5	4	137	.01	.37	5.4	71	0
Chicken	22	4	3	136	.01	.33	7.3	70	0
Lamb	21	4	3	132	.01	.37	6.5	71	0
Pork	20	5	2	133	.01	.37	25.0	72	0
11. **Lobster,** ¼ lb. A.P.:									
Fresh boiled	16	2	1	86	.02	.21	.4	80	0
Canned, ¾ cup	18	1	Tr.	81	...	...	....	80	0
12. **Loganberries:**									
Fresh, 1 cup	1	1	15	73	.04	.02	1.4	82	1
Canned, juice pack, ¾ cup	1	1	13	65	...	...	....	84	2

TABLE 1 (*Continued*)

VITAMINS IN FOODS

(Calculated for 100 Gram Portions)

Foods (Full description on opposite page)	Vitamin A I.U.	Vitamin B Complex						Ascorbic Acid mg.	Vitamin D I.U.
		Thiamine mcg.	Riboflavin mcg.	Niacin mg.	Pantothenic Acid mcg.	Pyridoxine mcg.	Biotin mcg.		
1. **Kumquats**........	..		.	.	.		..	34	
2. **Lamb,** cooked: (Vitamin content after cooking 100 Gm. [raw wt.])									
Chops, fried or broiled:									
Rib............	0	150	210	4.6	.....	210	.....	...	...
Shoulder........	0	135	215	4.9	.....	.	...	...	.
Patties..........	0	150	200	4.6	.....	...	.....	...	.
Roasts:									
Leg............	0	150	240	5.4	500	150	5.9	...	.
Shoulder........	0	125	210	4.6	.....	.	.....	...	.
Stew meat (breast)	0	...	280	3.6	.....	200	....	..	
3. **Lard**									
4. **Leeks,** fresh........	120	96	.....	.....	.....	.	.	15	..
5. **Lemon juice,** fresh...	0	40	4	.1	.....		..	45	
6. **Lemonade**..........	0	7	0	0	.....		.	7	.
7. **Lentils,** dry......	.....	450	185	3.1	.....	..	...	0	
8. **Lettuce:**									
Inner leaves.......	100	60	70	.2	110	71	3.1	8	...
Outer leaves.......	5,500								
9. **Limes**	.	40	...	.1	.....	..		27	
10. **Liver,** cooked: (Vitamin content after cooking 100 Gm.)									
Beef.............	17,280	210	2,650	15.0	4,200	500	101.0	15	45
Calf.............	9,000	165	3,100	14.2	2,500	210	75.2	17	15
Chicken..........	24,000	225	1,050	8.0	.....		....	12	50
Lamb............	36,000	350	2,500	14.3	2,600	260	127.0	25	20
Pork............	9,000	330	2,560	12.2	2,500	230	84.7	12	45
11. **Lobster:**									
Fresh boiled.......	150	125	.....	.....	.....			5	
Canned...........	115	100	.....	.....	.....				
12. **Loganberries:**									
Fresh	33		----					30	
Canned	----							20	

TABLE 1 (*Continued*)

PROXIMATE COMPOSITION OF FOODS

(Calculated for 100 Gram Portions)

Foods Approx. Measure of 100 Gm.	Protein Gm.	Fat Gm.	Carbohydrate Gm.	Calories	Minerals			Water Gm.	Fiber Gm.
					Ca Gm.	P Gm.	Fe mg.		
1. **Loganberry juice,** ½ c.	1	0	10	44	...	...	....	88	0
2. **Macaroni:**									
Dry, uncooked, 1 c.	13	1	74	357	.02	.14	1.2	11	Tr.
Cooked, plain, ½ c.	4	Tr.	19	92	Tr.	.03	.2	76	Tr.
3. **Macaroons,** 8 average	6	17	65	437	...	...	....	..	1
4. **Margarine,** ½ c. Vitamin A added	1	81	Tr.	733	Tr.	.02	.02	16	0
5. **Marmalade,** orange, ¼ c.	1	...	85	344	.03	.01	.3	14	..
6. **Mayonnaise,** 7 tbsp.	2	78	3	722	.02	.06	1.0	16	..
7. **Meat or poultry** (*See* Beef, Lamb, Pork, etc.):									
Cooked (all kinds):									
Lean:									
Well done, dry	34	6	0	190	...	...	....	..	..
Medium done	30	6	0	174	...	...	....	..	..
Rare	27	6	0	162	...	...	....	..	..
Medium fat:									
Well done, dry	30	18	0	282	...	...	....	..	..
Medium done	27	18	0	270	...	...	....	..	..
Rare	23	18	0	254	...	...	....	..	..
Fat:									
Medium done	22	30	0	358	...	...	....	..	..
8. **Milk:**									
Cow:									
Fresh, ½ c.:									
Whole	3.5	4	5	70	.12	.09	.1	87	0
Skim	3.5	Tr.	5	34	.12	.09	.1	91	0
Canned, 5–6 tbsp.:									
Evaporated	7	8	10	140	.24	.20	.2	74	0
Condensed	8	8	55	324	.27	.23	.2	27	0
Dried, 1 c. (scant):									
Whole	26	27	38	499	.95	.73	.6	4	0
Skim	36	1	52	361	1.30	1.03	.6	4	0
Malted, plain, ½ c.	15	9	71	425	.36	.35	1.0	4	Tr.
Goat, ½ c.:									
Fresh	3	4	5	68	.13	.10	.2	87	0
Human, ½ c.:									
Fresh	1.5	4	7	70	.03	.02	.2	87	0

TABLE 1 (*Continued*)

VITAMINS IN FOODS

(Calculated for 100 Gram Portions)

Foods (Full description on opposite page)	Vitamin A I.U.	Vitamin B Complex						Ascorbic Acid mg.	Vitamin D I.U.
		Thiamine mcg.	Riboflavin mcg.	Niacin mg.	Pantothenic Acid mcg.	Pyridoxine mcg.	Biotin mcg.		
1. **Loganberry juice**.....	......	.....	.....	.....	.....	...	.....	26	
2. **Macaroni:**									
Dry..............	0	130	80	2.1	.....	...	.....	0	
Cooked..........	0	20	.....	.....	.....	...	.....	0	
3. **Macaroons**..........	......	.....	.....	.....	.....	...	.....		
4. **Margarine**									
Vitamin A added..	3,330	6	.....	.....	.....	...	.....	0	
5. **Marmalade,** orange..	0	20	20	.1	.....	...	.....	8	
6. **Mayonnaise**.........	200	40	40	0	.....	...	.....	0	

7. **Meat or poultry:**

Cooked:

Summary vitamin values for meats are impossible because of wide variation. In general cooked meats are good sources of several fractions of the B complex. With the exception of organ meats they contain almost none of vitamins A and C.

Specific vitamin values are given for various cuts and methods of cooking under each type of meat and poultry. (*See* Beef, Chicken, Lamb, etc.) Losses in cooking are discussed and tabulated in Chapter 45, Meats and Poultry.

Foods	Vitamin A I.U.	Thiamine mcg.	Riboflavin mcg.	Niacin mg.	Pantothenic Acid mcg.	Pyridoxine mcg.	Biotin mcg.	Ascorbic Acid mg.	Vitamin D I.U.
8. **Milk:**									
Cow:									
Fresh:									
Whole .	160	40	170	.1	290	6	5.0	1	3
Skim	12	40	180	.1	300			1	0
Canned:									
Evaporated*.	400	50	360	.2				1	135
Condensed	430	50	390	.2				1	
Dried:									
Whole ...	1,400	300	1,460	.7				6	16
Skim	40	350	1,960	1.1				7	0
Malted, plain*		340	500		—	—		...	79
Goat:									
Fresh .	170	57	82	.3				2	5
Human:									
Fresh...........	350	20–300	60	.3				6	

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* Irradiated or fortified with vitamin D.

Table 1 (*Continued*)

PROXIMATE COMPOSITION OF FOODS

(Calculated for 100 Gram Portions)

Foods Approx. Measure of 100 Gm.	Protein Gm.	Fat Gm.	Carbohydrate Gm.	Calories	Minerals			Water Gm.	Fiber Gm.
					Ca Gm.	P Gm.	Fe mg.		
1. **Molasses,** cane, med., ⅓ c.	0	0	69	276	.27	.05	6.7	24	0
2. **Muffins:**									
Bran, 3 2¼″ diam.	10	5	45	265	.15	.40	4.2	..	1
Plain, 3 2¼″ diam.	8	9	45	293	.08	.11	1.0	..	..
3. **Mushrooms:**									
Fresh, 1½ c.	....	Tr.	...	...	.02	.10	.8	..	1
Canned, 1 c.	....	Tr.	...	...	.02	.10	.8	..	1
4. **Muskmelons** (*See* Cantaloupe)									
5. **Mustard greens,** 2½ c. packed (½ c. cooked)	2	Tr.	4	24	.22	.04	2.9	93	1
6. **Mutton:**									
Wholesale cuts (see Lamb)									
Cooked (see Meats, cooked)									
7. **Nectarines,** 2 med.	1	Tr.	16	68	0	.02	.5	82	Tr.
8. **Noodles,** egg, dry, ½ c. broken	14	5	71	385	.02	.16	1.9	9	Tr.
9. **Oatmeal** (or rolled oats):									
Dry, uncooked, 1⅓ c.	14	7	68	391	.05	.37	5.2	8	1
Cooked, ½ c.	2	1	11	61	.01	.07	.9	85	Tr.
Gruel, ½ c.	1	Tr.	4	20	0	0	.2	94	Tr.
10. **Oils, salad,** ½ c.	0	100	0	900	0	0	0	0	0
11. **Okra,** 10 pods	2	Tr.	7	36	.08	.06	.7	90	1
12. **Oleomargarine** (*See* Margarine)									
13. **Olives:**									
Green, pickled, 12 med.	2	14	4	150	.10	.02	2.0	75	1
Ripe, pickled, 10 lg.	2	19	3	191	.12	.01	2.9	75	2

TABLE 1 (*Continued*)

VITAMINS IN FOODS

(Calculated for 100 Gram Portions)

Foods (Full description on opposite page)	Vitamin A I.U.	Vitamin B Complex						Ascorbic Acid mg.	Vitamin D I.U.
		Thiamine mcg.	Riboflavin mcg.	Niacin mg.	Pantothenic Acid mcg.	Pyridoxine mcg.	Biotin mcg.		
1. **Molasses**	0	80	160	.3	260	270	9.1	0	
2. **Muffins:**									
Bran	380	165	165	....	.....	.			
Plain	485	64	155	...	..		.		
3. **Mushrooms:**									
Fresh	0	150	420	6.9	1,700	45	16.0	6	.
Canned	0	.....	190	1.6	940	...	.....	2	
4. **Muskmelons**									
5. **Mustard greens,** raw	6,460	90	200	.8	.....	...	.....	102	
Cooked	8,000	.....	...	.....	.....	...	.....	27	
6. **Mutton**									
7. **Nectarines**	1,500	72	...	.....	.....	...	.....	16	
8. **Noodles**	180	130	120	2.1	.....	...	.....	0	...
9. **Oatmeal:**									
Dry	......	550	140	1.1	1,100	250	.....	0	
Cooked	......	100	20	.3	.....	...	.....	0	
Gruel	......	.....	...	.....	.....	...	.....		
10. **Oils, salad**	......	.....	...	.....	.....	...	.....	0	
11. **Okra**	740	120	100	.7	210	75	5.5	30	
12. **Oleomargarine**									
13. **Olives:**									
Green, pickled	420	10	290	.....	.....	...	.....	30	...
Ripe, pickled	346	10	...	.....	.....	...	.....	15	

TABLE 1 (*Continued*)

PROXIMATE COMPOSITION OF FOODS

(Calculated for 100 Gram Portions)

Foods Approx. Measure of 100 Gm.	Protein Gm.	Fat Gm.	Carbohydrate Gm.	Calories	Minerals			Water Gm.	Fiber Gm.
					Ca Gm.	P Gm.	Fe mg.		
1. **Onions:**									
Mature, 2 sm. or 1 lg.	1	Tr.	10	44	.03	.04	.5	88	1
½ c. diced	....	....	...	...	...	...	....	..	..
Young, green, 24	1	Tr.	11	48	.03	.05	.6	87	2
2. **Oranges** (all kinds), 1 sm.	1	Tr.	11	48	.03	.02	.4	87	1
3. **Orange juice,** ½ c.	1	0	13	56	.03	.02	.2	86	0
4. **Orangeade,** ½ c.	Tr.	0	5	20	...	...	....	95	..
5. **Oysters,** solids only:									
Fresh or canned, 4 lg. or 6 sm.	10	2	6	82	.07	.17	7.1	80	0
Oyster stew (with milk), ½ c.	5	5	5	85	.10	...	2.4	83	
6. **Papaws,** 1 med.	5	1	17	97	...	...	....	76	
7. **Papayas,** ½ med.	1	Tr.	10	44	.02	.01	.3	88	1
8. **Parsley,** 2 c., cut	4	1	9	61	.19	.08	3.2	85	2
9. **Parsnips,** 1 c., sliced	2	1	18	89	.06	.08	.7	79	2
10. **Pâté de foie gras,** ⅓ c.	11	44	5	460	...	...	....	..	0
11. **Peaches:**									
Fresh, 1 med.	1	Tr.	12	52	.01	.02	.6	87	1
Canned, 2 halves:									
Water pack	1	Tr.	7	32	.01	.02	.4	91	Tr.
Juice pack	Tr.	Tr.	9	36	...	...	....	90	Tr.
In sirup	Tr.	Tr.	18	72	0	.01	.4	81	Tr.
Dried, 6 halves	3	1	69	297	.04	.13	6.9	24	4
12. **Peanuts,** ¾ c. shelled:									
Roasted	27	44	24	600	.07	.39	1.9	3	2
Roasted, buttered, salted	27	52	20	656	.07	.40	2.0	1	4
13. **Peanut butter,** 6 tbsp.	26	48	21	620	.07	.39	1.9	2	2

Table 1 (*Continued*)

VITAMINS IN FOODS

(Calculated for 100 Gram Portions)

Foods (Full description on opposite page)	Vitamin A I.U.	Vitamin B Complex						Ascorbic Acid mg.	Vitamin D I.U.
		Thiamine mcg.	Riboflavin mcg.	Niacin mg.	Pantothenic Acid mcg.	Pyridoxine mcg.	Biotin mcg.		
1. Onions:									
Mature, raw	50	30	20	.1	130	63	3.5	9	...
Cooked	.....	17	...	.....	.....	...	.....	5	..
Young, raw	3,600	30	123	.1	.....	...	.....	28	..
2. Oranges	190	80	30	.2	340	80	1.9	50	...
3. Orange juice	225	68	15	.2	120	80	.....	50	.
4. Orangeade						.	...	.	
5. Oysters, solids only:									
Fresh	170	180	230	1.2	490	33	8.7	3	5
Oyster stew	346	105	...	.....	.....	...	.....	.	...
6. Papaws	.....	.....	...	.....	.....	...	.....	36	.
7. Papayas	2,500	23	50	.....	.....	...	.....	45	.
8. Parsley	30,000	.....	...	.....	.....	...	.....	100	..
9. Parsnips, raw	0	110	90	.2	.....	...	.....	18	. .
Cooked	.....	.....	...	.....	.....	...	.....	14	...
10. Pâté de foie gras	.....	30	...	.....	.....	...	.....		
11. Peaches:									
Fresh:									
White	5	20	50	.9		.		8	
Yellow	1,500								
Canned:									
Clingstone	440	10	15	.4	49	...	.....	4	
Freestone	260	10	15	.6	70	...	.....	12	
Dried, sulfured	3,250	10	200	5.4	.....	...	.....	19	
12. Peanuts:									
Raw	.....	1,000	...	17.0	.....	...	.....		
Roasted	0	330	160	16.2	2,500	300	34.0	0	
13. Peanut butter	0	200	160	16.2	.....	...	.....	0	

TABLE 1 (*Continued*)

PROXIMATE COMPOSITION OF FOODS

(Calculated for 100 Gram Portions)

Foods Approx. Measure of 100 Gm.	Protein Gm.	Fat Gm.	Carbohydrate Gm.	Calories	Minerals			Water Gm.	Fiber Gm.
					Ca Gm.	P Gm.	Fe mg.		
1. **Pears:**									
Fresh, 1 large	1	Tr.	16	68	.01	.02	.3	83	1
Canned, 2 halves:									
Water pack	Tr.	Tr.	8	32	.01	.01	.2	92	1
Juice pack	Tr.	Tr.	12	48	...	...	....	88	1
In sirup	Tr.	Tr.	18	72	.01	.01	.2	81	1
Dried, 5 halves	2	Tr.	72	296	...	...	....	24	6
2. **Peas:**									
Fresh, shelled, ¾ c.:									
Young	5	Tr.	12	68	...	...	....	83	2
Medium	7	Tr.	16	92	.02	.12	1.9	77	2
Old	8	Tr.	25	132	...	...	....	67	3
Canned, medium, ½ c.	3	Tr.	13	64	.03	.07	1.8	83	1
Dried, split, ½ c.	25	1	62	357	.07	.40	6.0	10	1
3. **Pecans,** ⅞ c.:									
Raw	11	70	15	734	.09	.34	2.6	3	
Roasted, buttered, salted	9	73	13	745	.07	.32	2.4	3	3
4. **Peppers,** green, 1 lg.	1	Tr.	6	28	.01	.03	.4	92	1
5. **Persimmons,** native, ½ c. pulp	1	Tr.	34	140	.02	.02	0	64	2
6. **Pheasant,** total edible, ½ breast or 1 thigh	24	5	0	141	.05	.31	3.7	70	0
7. **Pickles:**									
Cucumber, sweet, 8 sm.	Tr.	Tr.	21	84	.02	.02	.6	77	
Sour or dill, 1 med.	1	Tr.	2	12	.02	.02	.9	95	
8. **Pies,** ⅛ av. pie:									
Apple	2	9	32	217	.01	.02	.3		
Custard	6	10	33	246	.10	.10	.8		
Lemon meringue	3	8	34	220	.01	.04	.5		
Mince	5	12	35	268	.01	.06	1.0		
Pumpkin	5	9	36	245	.10	.10	.8	..	..
9. **Pimentos,** canned	1	1	6	37	...	...	....	91	1
10. **Pineapple:**									
Fresh, 2 sl. ½″	Tr.	Tr.	14	56	.02	.01	.3	85	Tr.
Canned, 2 sl.:									
Water pack	Tr.	Tr.	13	52	...	...	....	86	Tr.
Juice pack	Tr.	Tr.	15	60	.01	.01	.3	84	Tr.
In sirup	Tr.	Tr.	21	84	.03	.01	.6	78	Tr.

Table 1 (*Continued*)

VITAMINS IN FOODS

(Calculated for 100 Gram Portions)

Foods (Full description on opposite page)	Vitamin A I.U.	Vitamin B Complex						Ascorbic Acid mg.	Vitamin D I.U.
		Thiamine mcg.	Riboflavin mcg.	Niacin mg.	Pantothenic Acid mcg.	Pyridoxine mcg.	Biotin mcg.		
1. Pears:									
Fresh	20	20	40	.1	.....	...	.....	4	...
Canned:									
Water pack	10	10	20	.1	25	...	.....	2	
Juice pack									
In sirup									
Dried	5	.....	170	.....	.....	...	.....	0	
2. Peas:									
Fresh:									
Young	680	360	180	2.1	380	79	9.4	26	
Medium									
Old									
Canned	540	110	60	.9	150	...	.....	8	
Dried, green	370	870	290	3.0	.....	300	18.0	0	
3. Pecans:									
Raw	50	720	110	.9	.....	...	.....	2	
Roasted	.....	.....	...	.....			...	0	
4. Peppers, green	630	70	40	.4	.....	...	.....	120	...
5. Persimmons	2,550	.....	...	.....	.....			43	
6. Pheasant	.....	.....	...	.....	.....				
7. Pickles:									
Cucumber, sweet	.....	.....	...	.....	.....	...	.....		
Sour or dill	190	10	20	.....	.....	...	.....	7	
8. Pies:									
Apple	100	40	20	.5	.....	...	.....	1	
Custard	300	60	180	.2	.....	...	.....	0	18
Lemon meringue	170	30	50	.1	.....	...	.....	1	10
Mince	90	35	65	.2	.....	...	.....		
Pumpkin	600	55	140	.4	.....	...	.....		18
9. Pimentos	7,500	20	65	.4	180	...	.....	80	
10. Pineapple:									
Fresh	130	80	20	.2	.....			24	
Canned:									
Water pack	80	70	20	.2	100	...	.....	9	
Juice pack									
In sirup									

TABLE 1 (*Continued*)

PROXIMATE COMPOSITION OF FOODS

(Calculated for 100 Gram Portions)

Foods Approx. Measure of 100 Gm.	Protein Gm.	Fat Gm.	Carbohydrate Gm.	Calories	Minerals			Water Gm.	Fiber Gm
					Ca Gm.	P Gm.	Fe mg.		
1. **Pineapple juice,** ½ c.:									
Canned	Tr.	Tr.	13	52	.02	.01	.5	86	0
2. **Pine nuts,** 1⅓ c. kernels:									
Pignolia	31	48	11	600	...	...	....	10	1
Piñon	13	61	21	685	...	...	....	4	
3. **Pistachio nuts,** ⅔ c.	20	53	19	633	...	...	7.9	7	2
4. **Plantains** (baking bananas), 1 med.	1	Tr.	33	136	...	...	....	65	Tr.
5. **Plums:**									
Fresh, 3 whole:									
Excluding prunes	1	Tr.	13	56	.02	.02	.5	86	1
Canned, 2 whole:									
Water pack	Tr.	Tr.	7	28	.01	.01	1.1	92	Tr.
Juice pack prunes	Tr.	Tr.	19	76	.01	.01	1.1	80	Tr.
In sirup, plums and prunes	Tr.	Tr.	20	80	.01	.01	1.1	79	Tr.
6. **Pokeberries,** ½ c.	3	Tr.	4	28	...	...	....	92	..
7. **Pomegranate,** 1 med.:									
Fresh pulp	1	...	18	76	.01	.11	.78	80	Tr.
Pulp and seeds	2	1	21	101	...	...	....	75	4
8. **Pork, fresh** 3½ oz., raw: (*See* Meat, Cooked, for average composition after cooking.)									
Chops and steaks:									
Leg	15	31	0	339	.01	.17	2.3	53	0
Loin	16	25	0	289	.01	.18	2.5	58	0
Shoulder	13	37	0	385	.01	.14	2.0	49	0
Roasts, med. fat:									
Boston butt	17	23	0	275	.01	.18	2.5	59	0
Leg (fresh ham)	15	31	0	339	.01	.17	2.3	53	0
Loin	16	25	0	289	.01	.18	2.5	58	0
Picnic shoulder	15	32	0	348	.01	.16	2.2	52	0
Spare ribs	15	32	0	348	.01	.16	2.2	52	0
Tenderloin	20	7	0	143	.01	.22	3.0	72	0

TABLE 1 (*Continued*)

VITAMINS IN FOODS

(Calculated for 100 Gram Portions)

Foods (Full description on opposite page)	Vitamin A I.U.	Vitamin B Complex						Ascorbic Acid mg.	Vitamin D I.U.
		Thiamine mcg.	Riboflavin mcg.	Niacin mg.	Pantothenic Acid mcg.	Pyridoxine mcg.	Biotin mcg.		
1. Pineapple juice:									
Canned	80	50	20	.2	100	...	...	9	...
2. Pine nuts:									
Pignolia	...	...	...	...	...	...	...	...	...
Piñon	...	...	...	...	...	...	...	...	...
3. Pistachio nuts	200	...	...	...	...	...	...	...	...
4. Plantains (baking bananas)	...	...	...	...	...	...	...	45	...
5. Plums:									
Fresh:									
Excluding prunes	350	150	30	.6	...	...	...	5	...
Canned:									
Water pack	230	30	30	.4	100	...		1	...
Juice pack									
In sirup									
6. Pokeberries, fresh	......	...	...	...	...	...	...	...	...
7. Pomegranate:									
Fresh pulp	...	...	...	...	...	...	...	16	...
Pulp and seeds	...	...	...	...	...	...	...	...	...
8. Pork, fresh, cooked: (Vitamin content after cooking 100 Gm. [raw wt.])									
Chops or steaks (fried or broiled):									
Leg	0	750	175	3.9	300	400	5.0	0	
Loin	0	810	190	4.2	500	380	5.2	0	
Shoulder	0	660	160	3.5	...	...		0	
Roasts:									
Boston butt	0	730	180	4.0	.	.		0	
Leg, fresh ham	0	675	165	3.7	270	300	5.0	0	
Lean	0	660	180	4.0	270	270	5.2	0	
Picnic shoulder	0	670	165	3.6	.	..		0	.
Spare ribs	0	640	160	3.5				0	
Tenderloin	0	560	360	3.1	.			0	

TABLE 1 (*Continued*)

PROXIMATE COMPOSITION OF FOODS

(Calculated for 100 Gram Portions)

Foods Approx. Measure of 100 Gm.	Protein Gm.	Fat Gm.	Carbohydrate Gm.	Calories	Minerals			Water Gm.	Fiber Gm
					Ca Gm.	P Gm.	Fe mg.		
1. **Pork, cured,** 3½ oz. raw:									
Bacon, med. fat	9	61	1	625	...	.11	.8	25	0
Bacon, Canadian	22	17	0	231	.01	.23	3.3	55	0
Ham, raw	17	35	Tr.	383	.01	.18	2.5	42	0
Ham, boiled	20	23	Tr.	287	.01	.25	2.7	51	0
Salt pork, med.	6	71	0	663	...	.06	.9	20	0
Salt pork, fat	4	82	0	754	...	.04	.6	10	0
2. **Potatoes,** sweet:									
Raw, ½ med.	2	1	28	129	.03	.05	.7	69	1
3. **Potatoes,** white, old:									
Raw, ½ c. diced	2	Tr.	19	84	.01	.06	.7	78	1
Boiled, 1 sm.	2	Tr.	18	80	.01	.06	.7	79	1
Baked, 1 sm.	3	Tr.	28	124	.01	.06	.7	69	3
French fried, 20 pieces	4	15	36	295	.02	.09	1.3	45	1
Mashed, ½ c.	3	8	19	160	...	...	....	70	.
4. **Potato chips,** 2 c.	7	37	49	557	.02	.10	2.4	6	
5. **Pretzels,** 5 med. (22 to lb.)	9	3	75	363	.03	.13	.2	..	Tr.
6. **Prunes:**									
Fresh, 3 whole	1	Tr.	22	92	...	...	....	76	1
Canned (see Plums, canned)									
Dried:									
Dry, 8–10 med.	2	1	71	301	.05	.09	3.9	24	2
Stewed, sweetened, 5 cooked	1	Tr.	41	168	.02	.03	.8	57	..
7. **Prune juice,** ½ c.	Tr.	0	19	...	.01	.02	.3	80	0
8. **Puddings:**									
Blanc Mange, cornstarch, ½ c.	4	4	23	144	.16	.11	.6		
Blanc Mange, chocolate, ½ c.	4	8	31	212	.14	.12	.3		

TABLE 1 (*Continued*)

VITAMINS IN FOODS

(Calculated for 100 Gram Portions)

Foods (Full description on opposite page)	Vitamin A I.U.	Vitamin B Complex						Ascorbic Acid mg.	Vitamin D I.U.
		Thiamine mcg.	Riboflavin mcg.	Niacin mg.	Pantothenic Acid mcg.	Pyridoxine mcg.	Biotin mcg.		
1. Pork, cured, cooked: (Vitamin content after cooking 100 Gm.)									
Bacon, med. fat...	0	400	67	1.9	.....	...	.....	0	.
Bacon, Canadian..	0	500	165	2.7	.....	...	.....	0	.
Ham, baked.......	0	540	175	3.4	.....	...	7.0	0	. .
Ham boiled (100 Gm. cooked)....	0	1,010	275	6.9	400	...	7.0	0	.
Salt pork, med.....	0	160	40	.9	.....	...	.....	0	.
2. Potatoes, sweet:									
Raw.............	7,700	100	60	.7	1,000	320	4.3	20	...
Cooked...........	7,100	90	60	.7	1,000	...	.....	10	...
3. Potatoes, white:									
Raw...........	20	110	40	1.2	320	220	.6	new 21 old 11	. . . .
Boiled, in skins..	40	90	...	.....	.....	...	.....	6–16	. .
Baked...........	40	105	34	.9	.....	...	.....	8	.
French fried......	70	175	65	.6	.....	...	.....	8	
Mashed...........	300	103	89	.3	.....	...	.....	0–3	8
4. Potato chips........	80	350	86	1.1					
5. Pretzels...........	.....	.		.....	.....	...	.....	0	
6. Prunes:									
Fresh	1,500	60	.	.....	.....	...	.....	0–5	
Canned	1,050	25	25	.4	44	...	.....	1	
Dried:									
Dry	1,890	100	160	1.7	.....	...	.....	3	
Stewed........	300	50	80	.....	.....	...	.....	0–2	
7. Prune juice.........	1,200	50		.4	.....	...	.....	3	
8. Puddings:									
Blanc Mange, cornstarch	195	59	244	....	....				
Blanc Mange, chocolate.......	195	61	244	...					

TABLE 1 (*Continued*)

PROXIMATE COMPOSITION OF FOODS

(Calculated for 100 Gram Portions)

Foods Approx. Measure of 100 Gm.	Protein Gm.	Fat Gm.	Carbohydrate Gm.	Calories	Minerals Ca Gm.	Minerals P Gm.	Minerals Fe mg.	Water Gm.	Fiber Gm.
1. Puddings (*Continued*):									
Bread, 6 tbsp.	5	8	16	156	.07	.08	.6	..	.
Brown Betty, 6 tbsp.	2	7	34	207	.02	.03	.4	..	
Custard (*See* Custard)									
Rice, creamy, ½ c.	3	3	19	115	.07	.07	.2	..	.
Tapioca, cream, ½ c.	5	5	21	149	.10	.11	.8	..	.
2. Pumpkin, ½ c.:									
Fresh	1	Tr.	7	32	.02	.04	.8	91	1
Canned	1	Tr.	8	36	.02	.04	.7	90	1
3. Quail, ¼ lb. A.P.	25	7	0	163	...	...	....	67	0
4. Quince, 3 med.	Tr.	Tr.	14	56	.01	.02	1.0	85	2
5. Rabbit, ¼ lb. A.P.:									
Domesticated:									
Raw, flesh only	21	10	0	174	.02	.18	.6	68	0
Wild:									
Raw, flesh only	21	5	0	129	...	...	....	73	0
6. Radishes, 8–10	1	Tr.	4	20	.04	.03	1.0	94	1
7. Raisins, ½ c.:									
Seeded	2	1	71	301	.08	.13	5.7	24	2
Seedless					.08	.13	3.0		
8. Raspberries:									
Fresh:									
Black, ¾ c.	2	2	16	90	.05	.05	1.0	79	4
Red, ¾ c.	1	1	14	69	.05	.05	1.0	83	3
Canned, red or black:									
Water pack, ½ c.	1	1	10	53	...	...	....	87	3
Juice pack, ½ c.	1	1	13	65	...	...	....	84	2
In sirup, ½ c.	1	1	28	125	...	...	....	69	2
9. Raspberry juice, ½ c.:									
Black	Tr.	0	11	44	...	...	....	88	0
Red	Tr.	0	8	32	...	...	....	91	0
10. Rhubarb, ½ c., cooked:									
Fresh	1	Tr.	4	20	*	.03	.5	95	1
Canned, water pack	Tr.	Tr.	3	12	*		....	96	1
Stewed, sweetened	1	Tr.	43	176	*	.03	.5	55	..

* Ca .05 mg. may not be available because of presence of oxalic acid.

Table 1 (*Continued*)

VITAMINS IN FOODS

(Calculated for 100 Gram Portions)

Foods (Full description on opposite page)	Vitamin A I.U.	Vitamin B Complex						Ascorbic Acid mg.	Vitamin D I.U.
		Thiamine mcg.	Riboflavin mcg.	Niacin mg.	Pantothenic Acid mcg.	Pyridoxine mcg.	Biotin mcg.		
1. Puddings (*Continued*):									
Bread	290	60	200	.....	.....	...	.....	...	...
Brown Betty	335	20	45	.....	.....	...	.....	...	...
Rice, creamy	78	25	110	.3	..	..	..	..	...
Tapioca, cream	378	63	218	.1	.....	...	.....	...	...
2. Pumpkin:									
Fresh	3,400	50	80	.6	400	...	.....	8	...
Canned	3,400	20	60	.5	.....	...	.....	0	...
3. Quail	......	.....	...	.....	.....	...	.....	...	...
4. Quince	......	.....	...	.....	.....	...	.....	10	..
5. Rabbit:									
Domesticated:									
Raw	......	77	58	9.5	.....	...	.....	4	..
Wild:									
Raw	......	.....	...	.....	.....	...	.....	...	...
6. Radishes	30	40	40	.1	.....	...	.....	24	...
7. Raisins:									
Seeded	50	150	80	.5	90	94	3.1	0	...
Seedless									
8. Raspberries:									
Fresh:									
Black	...	25	...	.....	.....	...	.....	12	...
Red	133							22	...
Canned:									
Water pack	100	6	...	.....	.....	...	.....	10	..
Juice pack									
In sirup									
9. Raspberry juice:									
Black	..	...	..			..	.....	..	
Red	100	20	...	.....	.....	...	.....	12	...
10. Rhubarb:									
Fresh	30	10	...	.1	.....	...	.....	9	...
Canned	......	.....	...	.....	.....	...	.....	3	...
Stewed	......	.....	...	.....	.....	...	.....	5	...

TABLE 1 (*Continued*)

PROXIMATE COMPOSITION OF FOODS

(Calculated for 100 Gram Portions)

Foods Approx. Measure of 100 Gm.	Protein Gm.	Fat Gm.	Carbohydrate Gm.	Calories	Minerals			Water Gm.	Fiber Gm.
					Ca Gm.	P Gm.	Fe mg.		
1. **Rice:**									
Brown, ½ c.:									
Uncooked	8	2	78	362	.04	.30	5.5	11	1
White, ½ c.:									
Uncooked	8	Tr.	79	348	.01	.09	.7	12	Tr.
Boiled	2	Tr.	23	100	.01	.03	.3	74	Tr.
2. **Rice,** wild, ½ c.	14	1	76	369	...	...	....	8	1
3. **Rice flakes,** puffed, etc., 4–6 c.	7	Tr.	83	360	.01	.09	.9	9	Tr.
4. **Rice polishings,** ¾ c.	12	10	64	394	...	...	....	..	2
5. **Rolls,** 3 med.:									
Hard, no milk	8	4	63	320	.01	.07	2.4	23	Tr.
Parker House	8	7	50	295	.05	.10	1.7	33	Tr.
Whole wheat	8	4	55	288	.02	.14	2.0	31	Tr.
6. **Rose apple**	1	Tr.	13	56	...	...	....	..	1
7. **Rutabagas,** ⅔ c. diced	1	Tr.	9	40	.06	.04	.4	89	1
8. **Rye flour, ⅚ c.:**									
Dark	15	2	70	358	...	...	....	12	2
Medium	11	2	75	362	.06	.37	4.8	10	2
Light	9	1	79	361	.02	.28	1.3	11	1
9. **Rye wafers,** 10	13	2	75	370	...	...	....	..	2
10. **Salad dressing,** ½ c.:									
Mayonnaise	2	78	3	722	.02	.06	1.0	16	0
Commercial (other than mayonnaise):									
Plain	1	37	14	393	.01	.03	.4	45	0
French	0	65	0	585	...	...	....	30	0
Thousand Island	4	36	10	380	...	...	....	..	Tr.
Home cooked, boiled	5	10	15	170	...	...	....	69	0
11. **Salmon** (*See* Fish)									
12. **Sardines** (*See* Fish)									
13. **Sauerkraut,** bulk, ⅔ c.	1	Tr.	5	24	.04	.03	.4	93	1

TABLE 1 (*Continued*)

VITAMINS IN FOODS

(Calculated for 100 Gram Portions)

Foods Full description (on opposite page)	Vitamin A I.U.	Vitamin B Complex						Ascorbic Acid mg	Vitamin D I.U.
		Thiamine mcg.	Riboflavin mcg.	Niacin mg.	Pantothenic Acid mcg.	Pyridoxine mcg.	Biotin mcg.		
1. Rice:									
Brown:									
Uncooked	0	290	50	4.6	.....	...	.....	0	...
Boiled	0	145	40	.....	.....	...	.....	0	...
Converted	0	230	40	3.8	.....	...	.....	0	...
White:									
Uncooked		50	30	1.4	400			0	...
2. Rice, wild	......	600	...	.....	.....	...	.....	.	
3. Rice, Krispies	......	450*	70	8.0*	340	48	1.3	0	...
Puffed rice	.	640*	60	4.6*					
4. Rice polishings	......	1,900	...	63.0	.....	...	.....	0	...
5. Rolls, enriched:									
Hard, no milk		200	130	1.9	....	...	..		..
Parker House	......	245	220	1.7	.....	...	.....	.	...
Whole wheat	......	310	140	2.2	.....	...	.....		.
6. Rose apple, fresh	......	.....	...	.....	.....	...	.....	820	..
7. Rutabagas:									
White	0	60	60	.5	.....	...	.....	36	...
Yellow	330								
8. Rye flour:									
Dark, whole grain	0	470	210	1.7	1,340	...	.....	0	...
Medium	0	.....	82	.....	..	..	..	0	...
Light	0	150	70	.9	710	...	.....	0	
9. Rye wafers	......	.....	...	.....	.....	...	.....	0	
10. Salad dressing:									
Mayonnaise	200	40	40	.....	.....	...	.....	0	
Commercial:									
Plain	140	20	30	.....	.....	...	.....	0	
French	......	.....	...	.....	.....	...	.....	0	
Home cooked	490	60	150	.....	.....	...	.....	0	
11. Salmon									
12. Sardines									
13. Sauerkraut	13	34	41	.1	93	...	.....	5	

* Restored by the addition of vitamins.

TABLE 1 (*Continued*)

PROXIMATE COMPOSITION OF FOODS

(Calculated for 100 Gram Portions)

Foods Approx. Measure of 100 Gm.	Protein Gm.	Fat Gm.	Carbohydrate Gm.	Calories	Minerals			Water Gm.	Fiber Gm.
					Ca Gm.	P Gm.	Fe mg.		
1. **Sausages and cooked specialties:**									
Bologna, all meat, 3 sl. ⅛″ th.	15	16	0	204	...	.17	2.3	62	0
Deviled ham, canned	19	43	0	463	.01	...	....	34	0
Frankfurters, 2 small	15	16	0	204	.01	.17	2.3	66	0
Head cheese, 2 sl.	13	12	0	160	...	.15	.7	..	0
Liver sausage, 3 sl. ¼″ th.	17	21	2	265	...	.23	5.3	59	0
Luncheon meats, 2 sl. ¼″ th.	15	23	0	267	.01	.16	1.3	60	0
Sausage, pork, raw, 5 small links or 2 med. patties	11	45	0	449	...	.10	1.4	42	0
Salami, 3 sl.	24	37	0	429	...	.27	3.7	37	0
Summer sausage, 3 sl.	24	34	0	402	...	.27	3.7	40	0
Vienna sausage, 5	15	17	0	213	...	.16	.5	64	0
2. **Scallops,** 6 sm. or ⅔ c.	15	Tr.	3	72	.02	.17	3.0	80	0
3. **Shad** (*See* Fish)									
4. **Shrimp,** canned, ½ c.	18	1	1	85	.08	.21	2.0	78	.
5. **Sirup,** ⅜ c.:									
Corn, commercial	0	0	81	324	.01	.01	1.5	18	0
Maple	0	0	64	256	.01	.01	3.0	35	0
Sorghum	0	0	67	268	...	...	....	32	0
6. **Soups,** ⅓–½ c.:									
Asparagus, cream	5	6	8	106	.10	.09	.4	..	Tr.
Bean, with bacon	6	2	18	114	.03	.02	2.0	..	..
Celery, cream	4	7	7	107	.10	.09	.4	..	Tr.
Chicken	4	1	7	37	...	...	....	..	..
Clam chowder without milk	3	4	10	88	...	...	....	..	..
Mushroom, cream	3	4	7	76	.08	.07	.4	..	..
Pea, split	4	4	11	96	.01	.05	1.1	..	Tr.
Potato, cream	3	4	10	88	.10	.09	.1	..	..
Tomato, clear	1	Tr.	9	40	.01	.02	.4	..	..
Tomato, cream	4	7	8	111	.10	.09	.5	..	..
Vegetable	4	1	13	77	.04	.04	.8	..	Tr.
7. **Soybeans,** shelled, 1 c.	13	7	8	147	.08	.22	3.0	70	2
Dried, ½ c.	35	18	31	426	.23	.59	8.0	8	10

VITAMINS IN FOODS

(Calculated for 100 Gram Portions)

Foods (Full description on opposite page)	Vitamin A I.U.	Vitamin B Complex						Ascorbic Acid mg.	Vitamin D I.U.
		Thiamine mcg.	Riboflavin mcg.	Niacin mg.	Pantothenic Acid mcg.	Pyridoxine mcg.	Biotin mcg.		
1. Sausages and cooked specialties:									
Bologna, all meat..	0	300	300	3.0	.....	...	.....	0	...
Deviled ham......	0	475	125	.....	.....	...	.....	0	
Frankfurters......	0	180	230	2.4	.....	...	.....	0	
Head cheese.......	0	80	120	1.1	.....	...	.....	0	
Liver sausage......	5,750	165	1,110	4.5	.....	...	.....	0	
Luncheon meats...	0	360	200	3.3	.....	...	.....	0	
Sausage, pork (after cooking 100 Gm.)	0	200	150	1.8	.....	...	.....	0	
Salami............	0	230	200	2.9	.....	...	.....	0	
Summer sausage...	0	460	360	4.1	.....	...	.....	0	
Vienna sausage....	0	50	150	2.8	.....	...	.....	0	...
2. Scallops, raw........	......	.....	.....	1.4	.....	...	.....	3	.
3. Shad									
4. Shrimp, dry pack....	60	10	30	1.9	290	...	.....	0	150
5. Sirup:									
Corn.............	0	0	0	0	0	0	0	0	0
Maple............	0	.....	.....	.....	.....	...	.....	...	0
Sorghum..........	0	.....	.....	.....	.....	...	.....	...	0
6. Soups:									
Asparagus, cream..	220	60	200	.2	.....	...	.....	...	
Bean, with bacon..	......	84	75	.7	.....	...	.....		
Celery, cream.....	215	45	130	.1	.....	...	.....		
Chicken.........	......	.....	.....	.....	.....				
Clam chowder without milk....	23	50	40	.....	.....	...	.....	...	
Mushroom, cream.	400	44	133	.....	.....	...	.....	...	
Pea, split.........	100	60	50	.2	.....	...	.....	...	
Potato, cream.....	310	70	122	.....	.....	...	.....	...	
Tomato, clear.....	700	50	30	.7	.....	...	.....	10	..
Tomato, cream....	500	50	110	.3	.....	...	.....	7	..
Vegetable.........	400	50	50	.....	.....	...	.....	...	
7. Soybeans, shelled ..	200	525	275					35	
Dried.............	110	1,140	310	2.1	.....	...	.....	0	

TABLE 1 (*Continued*)

PROXIMATE COMPOSITION OF FOODS

(Calculated for 100 Gram Portions)

Foods Approx. Measure of 100 Gm.	Protein Gm.	Fat Gm.	Carbohydrate Gm.	Calories	Minerals			Water Gm.	Fiber Gm.
					Ca Gm.	P Gm.	Fe mg.		
1. **Soybean flour, grits,** etc., 1 c.:									
Full fat	36	21	30	453	.20	.55	12.1	9	2
Medium fat, "expellor" type	43	7	33	367	.24	.61	13.0	9	2
Low fat, solvent ext.	45	1	29	305	.27	.62	13.0	11	2
2. **Soybean sprouts,** ½ c.	9	2	6	78	...	...	....	82	1
3. **Soy sauce,** ½ c.	2	1	9	53	...	...	....	..	0
4. **Spaghetti** (*See* Macaroni)									
5. **Spinach:**									
Fresh leaves, 2 c.	2	Tr.	3	20	*	.06	3.0	93	1
Cooked or canned, ½ c.	2	Tr.	4	24	*	.03	1.6	92	1
Canned, sieved, ½ c.	2	Tr.	3	20	*	.03	1.6	93	1
6. **Spinach,** New Zealand: Fresh leaves and stems, 2 c.	2	Tr.	4	24	...	...	....	93	1
7. **Squab** (*See* Chicken)									
8. **Squash:**									
Fresh:									
Summer, 1 med.	1	Tr.	4	20	.02	.02	.4	95	1
Winter, ½ c.	2	Tr.	9	44	.02	.03	.6	89	1
Canned:									
Winter, ½ c.	1	Tr.	8	36	.02	.03	.6	91	1
9. **Starch** (corn, arrowroot, etc.), 10 tbsp.	1	Tr.	87	352	0	0	0	12	Tr.
10. **Strawberries:**									
Fresh, 1 c.	1	1	8	45	.03	.03	.8	90	1
Canned, ½ c.:									
Water pack	1	Tr.	6	28	...	...	....	93	1
Juice pack	1	1	8	45	...	...	....	90	1
In sirup	1	Tr.	28	116	...	...	....	71	1
11. **Suet,** fat, 8 tbsp.	2	94	0	854	...	...	....	4	0
12. **Sugar,** ⅓ c.:									
Granulated (cane or beet)	0	0	100	400	0	0	.1	0	0
Brown, light or dark	0	0	96	384	.08	.04	2.6	3	0

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* Ca, .08 mg. for fresh spinach and .09 mg. for cooked, may not be available becaus of the presence of oxalic acid.

TABLE 1 (*Continued*)

VITAMINS IN FOODS

(Calculated for 100 Gram Portions)

Foods (Full description on opposite page)	Vitamin A I.U.	Vitamin B Complex						Ascorbic Acid mg.	Vitamin D I.U.
		Thiamine mcg.	Riboflavin mcg.	Niacin mg.	Pantothenic Acid mcg.	Pyridoxine mcg.	Biotin mcg.		
1. Soybean flour, grits, etc.:									
Full fat	140	770	280	2.2	1,500	...	...	0	
Medium fat	110	820	340	2.6	.....	...		0	
Low fat	70	1,100	350	2.9	.	.		0	
2. Soybean sprouts			...			...		.	
3. Soy sauce			23						
4. Spaghetti	.....	80	60	2.0	.....	...	...	.	
5. Spinach:									
Fresh leaves	9,920	120	240	.7	180	83	6.9	59	
Cooked or canned	6,790	20	80	.3	59	...	.	14	
Canned, sieved	6,200	27	105	.....	.....	.	....	13	
6. Spinach, N. Z.:									
Fresh	.....	63	...	.....	.....	..	....	39	
7. Squab									
8. Squash:									
Fresh:									
Summer	260	40	50	1.1	.....	..	...	17	
Winter	4,950	50	80	.6	.....		...	8	
Canned:									
Winter	950	40	50	.6	.....	..		3	
9. Starch	0	0	0	0	0	0	0	0	0
10. Strawberries:									
Fresh	60	30	70	.3	260	44	4.0	60	
Canned:									
Water pack Juice pack In sirup	.....			.3			...	20	
11. Suet	600	0	0	0	0	0	0	0	0
12. Sugar:									
Granulated	0	0	0	0	0	0	0	0	0
Brown	0	0	0	0	0	0	0	0	0

TABLE 1 (*Continued*)

PROXIMATE COMPOSITION OF FOODS

(Calculated for 100 Gram Portions)

Foods Approx. Measure of 100 Gm.	Protein Gm.	Fat Gm.	Carbohydrate Gm.	Calories	Minerals			Water Gm.	Fiber Gm.
					Ca Gm.	P Gm.	Fe mg.		
1. **Sugar** (*Continued*):									
Dextrose (unrefined or crystallized corn sugar)	0	0	90	360	0	0	0	10	0
Maple	0	0	90	360	.16	.01	3.0	9	0
2. **Sweetbreads,** ½ pair:									
Beef:									
Medium	12	33	0	345	...	...	....	54	0
Fat	10	41	0	409	...	...	....	47	0
Calf	20	3	0	107	...	...	....	76	0
3. **Swordfish** (*See* Fish)									
4. **Tangerines,** 1 lg.	1	Tr.	11	48	.03	.02	.4	87	1
5. **Tapioca,** dry, ½ c.	1	Tr.	86	348	.01	.01	1.0	13	Tr.
Pudding (See Puddings)									
6. **Taro** (*See* Dasheens)									
7. **Terrapin,** ¼ lb. A.P.	21	4	0	120	...	...	....	74	0
8. **Tomatoes:**									
Fresh, 1 med.	1	Tr.	4	20	.01	.03	.6	94	1
Canned, ½ c.	1	Tr.	4	20	.01	.03	.6	94	Tr.
9. **Tomato juice,** canned, ½ c.	1	Tr.	4	20	.01	.02	.4	94	Tr.
10. **Tomato purée,** ½ c.	2	1	7	45	.01	.04	1.1	89	Tr.
11. **Tongue,** ¼ lb. A.P.:									
Raw:									
Beef:									
Lean	17	11	Tr.	167	.01	.20	6.9	71	0
Medium	16	15	Tr.	199	.03	.12	6.9	68	0
Calf	19	5	1	125	...	...	....	75	0
Lamb	14	15	1	195	...	...	....	70	0
Pork	17	16	1	216	...	...	....	66	0
Canned or cured (beef, lamb, pork, etc.)	19	20	Tr.	256	...	...	....	60	0
12. **Tripe,** beef, pickled, 1 c.	12	1	0	57	.13	.13	1.6	86	0
13. **Trout** (*See* Fish)									

TABLE 1 (*Continued*)

VITAMINS IN FOODS

(Calculated for 100 Gram Portions)

Foods (Full description on opposite page)	Vitamin A I.U.	Vitamin B Complex						Ascorbic Acid mg.	Vitamin D I.U.
		Thiamine mcg.	Riboflavin mcg.	Niacin mg.	Pantothenic Acid mcg.	Pyridoxine mcg.	Biotin mcg.		
1. Sugar (*Continued*):									
Dextrose	0	0	0	0	0	0	0	0	0
Maple	0	.....	...	.....	....	...	.....	...	0
2. Sweetbreads:									
Beef, med.:									
Raw	......	150	550	.....	.....	...	.....	20	.
Cooked	......	60	266		.....	...	.....	..	.
Calf, med.	.....	330	510	3.3	.....	.	.....	18	
3. Swordfish									
4. Tangerines	420	70	30	.2	....	...	....	31	...
5. Tapioca, dry	0	.....	100	.....	....	..	.....	0	..
6. Taro									
7. Terrapin	......	...	...	....	....	...	...	6	
8. Tomatoes:									
Fresh	1,100	60	40	.6	370	60	4.0	23	
Canned	1,050	50	30	.7	230	. .	...	16	
9. Tomato juice:									
Fresh	1,050	60	40	.....		.	....	21	
Canned	1,050	50	30	.7	300	.	....	16	
10. Tomato purée	1,880	90	70	1.8	...		....	28	
11. Tongue:									
Beef, raw	0	230	280	6.0	1,060	125	3.3	0	
Lean	0	220	270	5.0	...	..		0	
Cooked, med.	0	50	200	2.2	500	75			
Calf, raw	......	. .		....	....	...			
Lamb, raw	......	.....	...	.....	....	...			
Pork, raw	......	.....	...	5.3	. .	.			
Canned or cured	......	.....	...	6.0	.				
12. Tripe, beef	0	7	90	1.0				0	
13. Trout									

TABLE 1 (*Continued*)

PROXIMATE COMPOSITION OF FOODS

(Calculated for 100 Gram Portions)

Foods Approx. Measure of 100 Gm.	Protein Gm.	Fat Gm.	Carbohydrate Gm.	Calories	Minerals			Water Gm.	Fiber Gm
					Ca Gm.	P Gm.	Fe mg.		
1. **Tuna fish** (*See* Fish)									
2. **Turkey,** ¼ lb. A.P.:									
Raw:									
Flesh, skin, giblets, fat	20	20	0	260	.02	.32	3.8	58	0
Dark meat only	23	9	0	173	.02	.42	5.9	67	0
Light meat only	25	5	0	145	.02	.37	5.2	69	0
Cooked (*See* Meat or poultry cooked)									
3. **Turnips,** ½ c. cubes, white or yellow	1	Tr.	7	32	.04	.03	.5	91	1
4. **Turnip tops,** ½ c. cooked	3	Tr.	5	32	.26	.05	2.4	90	1
5. **Turtle,** green, ¼ lb. A.P.:									
Raw	20	1	0	89	...	...	....	78	0
Canned	23	1	0	101	...	...	....	75	0
Variety Meats. (*See* Heart, Kidney, Liver, Sausage, Sweetbreads, Tongue, Tripe.)									
6. **Veal,** 3½ oz. raw: (*See* Meat, Cooked, for average composition after cooking.)									
Chops, 1 med.:									
Loin	19	11	0	175	.01	.21	2.9	69	0
Rib	19	14	0	202	.01	.21	2.9	66	0
Roasts:									
Leg	19	12	0	184	.01	.21	2.9	68	0
Loin	19	11	0	175	.01	.21	2.9	69	0
Rib	19	14	0	202	.01	.21	2.9	66	0
Shoulder	19	10	0	166	.01	.21	2.9	70	0
Steak:									
Round	20	9	0	161	.01	.21	2.9	70	0
Shoulder	19	10	0	166	.01	.21	2.9	70	0
Sirloin	19	11	0	175	.01	.21	2.9	69	0
Stew meat:									
Breast	18	17	0	225	.01	.20	2.7	64	0

TABLE 1 (*Continued*)

VITAMINS IN FOODS

(Calculated for 100 Gram Portions)

Foods Full description on opposite page	Vitamin A I.U.	Vitamin B Complex						Ascorbic Acid mg.	Vitamin D I.U.
		Thiamine mcg.	Riboflavin mcg.	Niacin mg.	Pantothenic Acid mcg	Pyridoxine mcg.	Biotin mcg.		
1. Tuna fish									
2. Turkey:									
Raw:									
Total edible	...	120	190	7.9	...	...	...	...	
Dark meat	...	175	260	6.5	...	...	...	...	...
Light meat	...	119	80	7.2	...	...	...	...	...
3. Turnips:									
Raw	...	60	60	.5	37	110	2.1	28	...
Cooked	...	38	...	...	...	...	...	14	...
4. Turnip tops, raw	9,500	100	560	.5	...	...		136	...
Cooked	10,000		450	...	...	...	...	44	...
5. Turtle green:									
Raw	...	...	...	...	...	...	...	6	...
Variety Meats. (*See* opposite page.)									
6. Veal, cooked: (Vitamin content after cooking 100 Gm. [raw wt.])									
Chops, fried or broiled:									
Loin	0	140	260	6.0	800	300	...	0	...
Rib	0	110	315	5.9	...	...	...	0	...
Roasts:									
Leg	0	125	240	5.7	700	210	...	0	...
Loin	0	125	250	5.7	...	210	...	0	...
Rib	0	125	300	5.6	...	...	...	0	...
Shoulder	0	115	290	5.5	...	...	...	0	...
Steak, fried or broiled:									
Round	0	140	260	6.1	...	...	...	0	...
Shoulder	0	130	300	5.8	...	...	...	0	...
Sirloin	0	140	260	6.0	...	...	...	0	...
Stew meat:									
Breast	0	75	230	5.5	...			0	...

TABLE 1 (*Continued*)

PROXIMATE COMPOSITION OF FOODS

(Calculated for 100 Gram Portions)

Foods Approx. Measure of 100 Gm.	Protein Gm.	Fat Gm.	Carbohydrate Gm.	Calories	Minerals			Water Gm.	Fiber Gm.
					Ca Gm.	P Gm.	Fe mg.		
1. **Vegetable oyster** or **salsify, 2 med.**	4	1	16	89	.06	.05	1.6	78	2
2. **Vinegar, ½ c.**	0	...	5	...	.02	.01	.3	91	..
3. **Walnuts, ½ c.** chopped:									
Black	18	58	19	670	...	...	6.0	3	2
English	15	64	16	700	.08	.38	2.1	3	5
4. **Water cress, 2 c.**	2	Tr.	3	20	.19	.01	3.0	94	1
5. **Watermelon,** 1 slice 2½" x 2½" x 1"	1	Tr.	7	32	.01	.01	.2	92	1
6. **Wheat flour, ¾ c.:**									
White:									
All-purpose	11	1	76	357	.02	.09	.7	12	Tr.
Bread	12	1	75	357	...	...	....	12	Tr.
Cake or pastry	8	1	79	357	...	...	....	12	Tr.
Enriched *	11	1	76	357	.02	.09	2.9	12	Tr.
Whole wheat	13	2	72	358	.04	.39	3.8	11	2
7. **Wheat breakfast foods:**									
Branflakes, 3½ c.	13	2	75	370	.12	.92	9.7	8	3
Farina (See Farina)									
Puffed wheat, 6¼ c.	13	2	76	374	.03	.04	.4	6	2
Shredded wheat, 3½	10	1	79	365	.04	.39	3.8	8	2
Wheatflakes, 2½ c.	10	1	80	369	.04	.35	4.5	6	2
Wheat meal (ground, cut, or cracked grain), ¾ c.	12	2	76	370	.04	.39	3.8	9	2
Wheat bran, packaged, 3 c.	16	4	66	364	.11	.89	6.8	..	8
8. **Wheat germ, ¾ c.**	25	10	50	390	.08	1.10	8.1	11	3
9. **White sauce, ½ c.**	4	13	10	173	.11	.12	2.8	..	..
10. **Yams, 1 med.**	2	Tr.	24	104	.04	.05	1.1	73	1
11. **Yeast:**									
Compressed moist, baker's, 6½ cakes	13	Tr.	13	104	.03	.61	4.9	71	Tr.
Dried, brewer's, ¾ c.	16	2	37	350	.11	1.89	18.2	7	1

* Addition of calcium optional.

TABLE 1 (*Continued*)

VITAMINS IN FOODS

(Calculated for 100 Gram Portions)

Foods (Full description on opposite page)	Vitamin A I.U.	Vitamin B Complex						Ascorbic Acid mg.	Vitamin D I.U.
		Thiamine mcg.	Riboflavin mcg.	Niacin mg.	Pantothenic Acid mcg.	Pyridoxine mcg.	Biotin mcg.		
1. Vegetable oyster	......	.....	.....	.....	.....	...	.....	7	...
2. Vinegar	0	0	0	0	0	0	0	0	0
3. Walnuts:									
Black	130	342	.....	.....	.....	...	.....	...	...
English	30	480	130	1.2	800	...	.....	3	...
4. Water cress	4,000	125	225	.....	.....	...	.....	100	...
5. Watermelon	590	50	50	.2	310	33	3.6	6	...
6. Wheat flour:									
White:									
All-purpose	0	70	30	.8	350	220	.7	0	...
Bread	0	.....	.....	.....	.....	...	.....	0	...
Cake	0	53	34	.8	.....	...	.....	0	...
Enriched*	0	440	264	3.5	.....	...	.....	0	...
Whole wheat	0	560	120	5.6	.....	...	.....	0	
7. Wheat breakfast foods:									
Branflakes	......	500*	250	8.2	.....	...	.....	0	
Cracked wheat, dry	......	420	165	4.4	.....	...	.....	0	
Puffed wheat	......	470*	140	8.4*	.....	...	.....	0	
Shredded wheat	10	220	150	4.2	.....	...	.....	0	
Wheatflakes	......	500*	200*	4.6	.....	...	.....	0	
Wheat meal	25	500	140	4.0	1,300	460	5.2	0	
Wheat bran	140	465	330	4.2	.....	...	.....	0	
8. Wheat germ	100	2,050	800	4.6	1,500	960	.....	0	...
9. White sauce	600	50	187	.....	.....	...	.....	...	...
10. Yams	3,000	112	90	.7	940	320	4.3	13	...
11. Yeast:									
Compressed moist, baker's	0	450	2,070	28.2	.....	...	.....	...	
Dried, brewer's	0	9,690	5,450	36.2	4,250	...	.....	0	

* Restored by the addition of vitamins.

TABLE 2

FOOD COMPOSITION TABLE FOR SHORT METHOD OF DIETARY ANALYSIS *

FOOD	APPROXIMATE MEASURE	WT.	CALORIES	PROT.	FAT	CARBOHYDRATE	Ca	P	Fe	VIT. A	ASCORBIC ACID	THIAMINE	RIBOFLAVIN	NIACIN
		Gm.		*Gm.*	*Gm.*	*Gm.*	*Gm.*	*Gm.*	*mg.*	*I.U.*	*mg.*	*mg.*	*mg.*	*mg.*
Cereal products: refined	1 sl. bread (30 Gm.); ½ c. cooked cereal and cereal products (20 Gm. dry); 1 c. prep. cereal (30 Gm.); 3 soda crackers (20 Gm.); 1½ c. popcorn (20 Gm.); 1 griddle cake		80	2.5	1	15	.01	.03	.2	—	—	.02	.02	.2
whole grain and enriched	1 sl. bread (30 Gm.); ½ c. cooked cereal (20 Gm. dry); 1 c. prep. cereal (30 Gm.); 2 graham crackers (20 Gm.)		80	2.5	1	15	.01	.04	.6	—	—	.06	.04	.6
Dairy products: butter	1 tsp.	5	35	—	4	—	—	—	—	160	—	—	—	—
cheese, Cheddar type	1 cu. in.	30	120	7.0	10	1	.25	.18	.3	430	—	.01	.14	—
cheese, cottage, skim	½ c.	100	100	19.0	1	4	.08	.26	.2	70	—	.01	.13	—
cream, light	⅛ c.	30	60	1.0	6	1	.03	.02	.1	360	—	.01	.04	—
custard	½ c.	130	150	7.0	7	15	.13	.14	.9	435	—	.08	.26	.1
eggs	1 med.	50	80	6.5	6	—	.03	.10	1.4	495	—	.07	.18	—
ice cream, commercial	⅔ c.	80	165	3.0	10	16	.06	.05	.2	265	—	.02	.21	.1
milk, buttermilk, skim	1 c.	240	90	8.5	1	12	.29	.23	.7	25	2	.11	.43	.2
milk, whole	1 c.	240	160	8.5	9	12	.28	.22	.5	410	2	.10	.43	.3
Desserts: cake, plain, chocolate	1 piece cake 2½ x 2½ x 2½ in. (75 Gm.), for iced, add 1 serving													

	sweets; 1 waffle 6 in. dia. (60 Gm.)		225	4.0	11	28	.03	.06	.8	175	—	.09	.11	.6
cookies, plain	2 med. 3 in. dia.; 1 brownie	40	150	2.0	7	20	.01	.03	.3	155	—	.04	.03	.2
pie crust	1/6 shell, single crust	25	105	1.5	6	11	—	.02	.4	—	—	.06	.04	.5
puddings, cream fillings	1/2 c.	140	210	4.5	6	35	.16	.13	.6	230		.06	.22	.1
Fats	2 sl. bacon (20 Gm.); 1 tbsp. fat (12 Gm.); 1 tbsp. mayonnaise (15 Gm.); 1 cu. in. salt pork (15 Gm.); 1½ tbsp. French dressing (15 Gm.)		120	1.0	13	–	–	.01	.2	5		.01	.01	.2
Fish: cod, haddock, fresh, cooked	1 med. serving	75	50	12.5	–	—	.01	.14	1.5		–	.05	.06	.8
halibut, herring, tuna, whitefish, cooked	1 med. serving; tuna (60 Gm.); others (75 Gm.)		105	15.0	5	—	.02	.17	.8	35		.04	.08	2.4
salmon, canned	1 med. serving	75	125	15.5	7	—	.05	.22	.7	220	—	.02	.12	5.9
Fruits: banana	1 small	100	95	1.0		23	.01	.03	.6	350	10	.04	.07	.6
cantaloupe	½ melon, 4½ in. dia.	150	35	1.0	–	8	.02	.02	.6	3,600	52	.08	.08	.1
citrus	1 med. orange; ½ med. grapefruit; ½ c. juice; 1 med. large lemon	100	50	1.0		11	.02	.02	.4	180	42	.07	.03	.2
yellow, fresh, canned, dried	fresh (100 Gm.): 1 med. peach, 2 to 3 apricots, 3 plums; dried (30 Gm.), add ½ serving sweets; for sweetened canned, dried or fresh, add 1 serving sweets		55	.5	—	13	.01	.02	.4	585	4	.01	.02	.6
other, dried	3 to 4 dates; 1½ to 2 small figs; dried apple; ¼ c. raisins	30	90	.5	–	22	.02	.03	.9	30	1	.04	.04	.2
other, fresh and canned	½ c. cooked; sweetened, add 1 serving sweets	100	65	.5	—	15	.01	.01	.4	80	6	.02	.02	.1
Gravy: white sauce	¼ c.	60	70	2.5	5	4	.05	.05	.2	180	—	.04	.11	.1

TABLE 2 (*Continued*)

FOOD COMPOSITION TABLE FOR SHORT METHOD OF DIETARY ANALYSIS *

FOOD	APPROXIMATE MEASURE	WT.	CALORIES	PROT.	FAT	CARBOHYDRATE	Ca	P	Fe	VIT. A	ASCORBIC ACID	THIAMINE	RIBOFLAVIN	NIACIN
		Gm.		*Gm.*	*Gm.*	*Gm.*	*Gm.*	*Gm.*	*mg.*	*I.U.*	*mg.*	*mg.*	*mg.*	*mg.*
Legumes: beans, peas	½ c. cooked; dried (30 Gm.)		105	6.5	—	19	.03	.12	2.4	20	—	.14	.06	.5
soybeans	½ c. cooked; dried (30 Gm.)		105	10.5	5	4	.07	.18	2.5	55	—	.24	.10	.8
Meat: beef, fowl, lamb, veal, cooked	1 med. serving	75	160	18.0	10	—	.01	.18	3.1	20	—	.09	.15	2.9
liver, cooked	1 small serving	60	80	12.0	2	4	.01	.22	4.9	16,500	9	.12	1.22	6.0
luncheon meats, cooked	2 sl. sausage, minced ham, dried beef, luncheon roll (30 Gm.); ½ frankfurter (30 Gm.)		80	5.0	6	1	—	.06	.7	—	—	.09	.07	.8
pork; ham, cooked	1 med. serving	75	205	18.0	15	—	.01	.18	2.4	—	—	.60	.15	3.2
Nuts	1 tbsp. peanut butter; 8 to 15 halves walnuts; 16 peanuts; 12 to 15 almonds; 12 halves pecans	15	95	3.5	8	3	.01	.06	.3	—	—	.03	.02	1.4
Sweets: candy; sugar; sirup	1 tbsp. sugar, jelly, jam, sirup, honey; 1 serving plain Jello; plain candy (fondant or mints, 14 Gm.); 6-oz. bottle soft drink		55	—	—	14	—	—	—	—	—	—	—	—
candy bar	1 2-oz. chocolate-coated bar		275	5.0	13	35	.05	.10	1.4	—	—	.03	.09	3.3
molasses; sorghum	1 tbsp.	20	50	—	—	12	.04	.01	1.3	—	—	.01	.04	—
Vegetables: cabbage; sauerkraut, cooked	⅔ c.	100	25	1.5	—	5	.05	.03	.5	30	28†	.05	.04	.2

cabbage, raw; cauliflower, cooked	1 c. cabbage (50 Gm.); ⅔ c. cauliflower (70 Gm.)...............		15	1.0	—	3	.02	.02	.3	20	26	.04	.03	.1
corn; parsnips, cooked	½ c. corn; 1 large parsnip	100	95	2.0	1	20	.02	.07	.4	75	6	.04	.05	.6
green and yellow;	⅔ c.	100	25	2.0	—	4	.02	.04	.9	775	38‡	.14‡	.11	1.0
asparagus, cooked														
broccoli, cooked	⅔ c.	100	35	3.5	—	6	.15	.08	1.4	4,800	63	.08	.28	.6
carrots, cooked	⅔ c.	100	40	1.0	—	9	.04	.04	.8	12,000	3	.04	.06	.5
green beans, cooked	½ c.	100	40	2.5	—	8	.06	.04	1.4	480	13‡	.06‡	.12	.4
leafy green, cooked	⅔ c. kale, spinach, turnip, other greens.....	100	30	2.5	—	4	.25§	.05	2.7	6,285	46‡	.08‡	.27	.5
peas, fresh, cooked, canned	½ c..................	100	70	4.5	—	12	.02	.09	1.4	590	11‡	.15‡	.09	1.1
sweet potato, cooked	½ large.....	100	130	2.0	1	28	.04	.05	.7	5,920	14	.08	.06	.5
potato, cooked	1 small; for fried add 1 serving fats.........	100	85	2.0	—	19	.01	.05	.7	35	8	.08	.03	1.0
tomato, fresh, canned, juice	½ c.; 1 small tomato (100 Gm.); 2½ tbsp. catsup (50 Gm.) add ½ serving sweets		20	1.0	—	4	.01	.02	.6	990	19	.05	.03	.7
other, cooked	½ c. beets, eggplant, onions, rutabagas, etc..............	100	45	1.5	—	10	.04	.04	.6	—	8	.01	.02	.2
other, commonly served raw	2 pieces celery; 8 sl. cucumber; ⅛ hd. lettuce..........	50	10	0.5	—	2	.02	.01	.2	70	3	.03	.02	.1

The nutritive value of food mixtures such as macaroni and cheese, Spanish rice, chow mein, creamed vegetables, soups, etc., should be computed on the basis of the kind and approximate amount of the foods in the combination.

† For sauerkraut, omit ascorbic acid.

‡ For canned, reduce ascorbic acid and thiamine by one half.

§ Calcium unavailable in chard, spinach and beet greens.

* Donelson, E. G., and J. M. Leichsenring: J. Am. Dietet. A. 21: 440, 1945.

TABLE 2 (*Continued*)

FOOD COMPOSITION TABLE FOR SHORT METHOD OF DIETARY ANALYSIS

EXPLANATION OF USE OF TABLE 2

To illustrate the use of the food composition table, a sample day's menu from a high-school girl's record is given.

Breakfast:	Oranges	1
	Cornflakes	1 serving
	Sugar	2 teaspoons
	Milk	1 cup
	Bread, white	2 slices
	Butter	2 teaspoons
	Jelly	4 teaspoons
Lunch:	Luncheon meat	1 slice
	Tomato	½
	Bread, white	2 slices
	Butter	2 teaspoons
	Banana	1 medium
	Cookies, chocolate	2
Midafternoon lunch:	Apple	1 small
	Candy, creams	4 pieces
Dinner:	Beef, roast	1 medium serving
	Potato, boiled	1 small
	Onions, creamed	½ cup
	Gravy	1 tablespoon
	Bread	1 slice
	Butter	1 teaspoon
	Milk	1 glass
	Celery	2 pieces
	Rhubarb sauce	½ cup

Summarizing this day's menu for calculation gives:

	Number of servings
Cereals: enriched	6
Dairy products:	
butter	5
milk, whole	1¾
Desserts: cookies	1
Fruits: banana	1
citrus	1
other, fresh and canned	2
Gravy: white sauce	1¼
Meat:	
beef	1
luncheon meat	½
Sweets	7
Vegetables:	
potato	1
tomato	½
other, cooked	½
other, commonly served raw	1

The nutritive content of the day's diet is determined by multiplying the values in the food composition table by the number of servings.

TABLE 3

100-CALORIE PORTIONS OF FOODS

	APPROXIMATE MEASURE CONTAINING 100 CALORIES	WEIGHT OZ.	WEIGHT GM.
Baked Goods, Bread, Cake, Cookies			
Biscuits, baking powder	1 average	1.0	28
Bread, white or whole wheat, fresh or toasted	1 slice ½″ x 4″ x 5″	1.3	38
Cake, angel food	1 piece 1½″ x 2″ x 2″	1.3	37
plain or chocolate	1 piece 1¾″ cube	1.0	28
sponge	1 piece 1½″ x 1½″ x 2″	1.2	33
Cookies, plain	1–3″ in diameter	0.8	24
Cornbread	1 slice 2″ x 2″ x 1″	1.3	38
Crackers, graham	2½ crackers	0.8	24
rich, fat	4 crackers	0.7	21
saltines	3 crackers	0.8	24
soda, large	4 crackers	0.8	24
Doughnut	½ medium	0.8	23
Griddlecake	2-3″ diameter	2.3	66
Muffin, bran	1 medium	1.3	38
plain wheat	1 small	1.2	34
Roll, plain	1 average	1.2	34
Waffle, plain	1–½″ thick	0.9	26
Cereals			
Cornflakes	1½ cups	1.0	28
Corn meal, dry	3 tbsp. (⅔ c. cooked)	1.0	28
Farina, dry	4 tbsp. (¾ c. cooked)	1.0	28
Oatmeal, dry	4 tbsp. (⅔ c. cooked)	1.0	28
Rice, puffed	1⅓ cups	1.0	28
Rice, dry	3 tbsp. (⅔ c. cooked)	1.0	28
Wheat meal, dry	4 tbsp. (¾ c. cooked)	1.0	28
Wheat, puffed	2 cups	0.9	26
Wheat, shredded biscuit	1 biscuit	1.0	28
Desserts			
Brown Betty	¼ cup, scant	1.7	48
Chocolate blancmange	¼ cup, scant	1.6	47
Custard, cup	⅓ cup	2.5	70
Gelatin dessert, lemon	1½ cups	3.9	110
Gingerbread	1 piece 1″ x 2″ x 2″	1.1	30
Junket	½ cup, scant	3.8	108
Ice cream	⅜ cup	1.7	47
Pie, apple	1 piece 1½″ at circumference	1.6	46
custard	1 piece 1½″ at circumference	1.5	41
lemon	1 piece 1½″ at circumference	1.6	45
mince	1 piece 1″ at circumference	1.3	37
pumpkin	1 piece 1½″ at circumference	1.5	41
Prune soufflé	⅓ cup	1.8	50
Rice pudding	½ cup, scant	3.1	88
Sherbets	⅓ cup	2.6	74
Tapioca cream	⅓ cup, scant	2.4	67
Eggs and Dairy Products			
Eggs, boiled or poached	1 large or 2 small	2.1	61
scrambled	¼ cup	1.6	47
omelet	1 egg	1.6	47
Butter	1 pat 1″ x 1″ x ¼″	0.5	13

TABLE 3 (*Continued*)

100-CALORIE PORTIONS OF FOODS

	APPROXIMATE MEASURE CONTAINING 100 CALORIES	WEIGHT	
		OZ.	GM.
Cream, thin 20 per cent	3 tbsp.	1.7	48
heavy	2 tbsp.	1.0	29
Milk, fresh	⅝ cup	5.0	143
evaporated	5 tbsp.	2.5	71
Cheese, Cheddar	1 piece 2″ x 1″ x ⅜″	0.9	25
cottage	5 tbsp.	3.3	100
Cheese soufflé	½ cup	0.7	19
Cocoa, ½ milk	¾ cup	6.5	185
Fruits			
Apple	2 small	5.9	167
Apple sauce (sugar)	⅔ cup	4.4	125
Apple, baked	1 large and 2 tbsp. juice	5.9	167
Apricots, dried	¼ cup	1.3	36
Banana	1 medium	3.7	104
Blueberries	1 cup	4.9	137
Cantaloupe	1⅓–4″ in diameter	14.7	417
Cherries, sour (stoned)	1¼ cups	5.4	154
Cranberry sauce	¼ cup, scant	1.7	49
Dates	5	1.1	31
Figs, dried	3¼	1.2	34
Grapes	35–40	4.9	137
Grape juice	⅝ cup	5.2	147
Grapefruit	1¼	8.0	227
Orange	2 small	7.3	208
Peach	2½ medium	6.8	192
Pear	1½ medium	5.2	147
Pineapple, fresh	3 slices 1″ thick	6.3	180
Pineapple, canned in sirup	1⅓ slices ¾″ thick	4.2	120
Plums	8 whole	6.3	180
Prunes, stewed	2 and 2 tbsp. juice	2.1	59
Rhubarb, stewed	¼ cup	2.0	57
Raisins, dry	1¼ tbsp.	1.2	33
Meat, Fish and Sea Food			
Bacon	4 small pieces	0.6	16
Beef, dried	4 slices 4″ x 5″	1.9	53
Beef stew	⅓ cup	3.2	92
Chicken, cooked	small serving (¼ cup)	2.0	57
creamed	¼ cup	1.6	45
Clams, meat only	8 or ⅔ cup	4.6	130
Codfish, creamed	½ cup	2.5	70
Halibut, boiled	1 piece 3″ x 1½″ x 1″	3.5	98
Ham, boiled	1 piece 4″ x 4¾″ x ⅛″	1.2	35
Hamburg steak, broiled	1 piece 2½″ in diameter x ⅞″	2.0	57
Lamb chop	1–2″ x 2″ x ½″	1.0	29
Liver	1 slice	2.7	76
Lobster, cooked	¾ cup	4.3	123
Mackerel, broiled	1 piece 3″ x 1″ x 1″	1.7	47
Oysters	5–7 medium	4.3	122
Roasts, beef	1 piece ¾″ x 1″ x 4″	1.2	34
lamb	1 piece 5″ x 2½″ x ¼″	1.5	43
veal	1 piece 2″ x 2¾″ x ⅛″	2.3	65
pork	1 piece 2″ x 2¼″ x ⅛″	1.2	35

TABLE 3 (*Continued*)

100-CALORIE PORTIONS OF FOODS

	APPROXIMATE MEASURE CONTAINING 100 CALORIES	WEIGHT OZ.	GM.
Salmon, canned	½ cup	2.0	58
Sausage, pork	1 link 3″	0.8	22
Steak, sirloin, med. fat	1 piece 1½″ x 1½″ x ¾″	1.2	34
Tongue, canned	2 small slices	1.4	39
Tuna fish, canned	¼ cup	1.6	45
Nuts			
Brazil nuts	2 nuts	0.5	15
Peanuts	1½ tbsp. shelled	0.6	17
Peanut butter	1 tbsp.	0.6	16
Pecans	2 tbsp.	0.5	14
Walnuts	1½ tbsp. chopped	0.5	15
Soups			
Asparagus (cream)	½ cup	3.3	94
Bean, with bacon	½ cup, scant	3.1	88
Bouillon	5 cups	44.0	1,250
Celery (cream)	½ cup	3.3	94
Chicken	1¼ cups	9.5	270
Clam chowder	½ cup	4.0	113
Consommé	4 cups	32.0	900
Mushroom (cream)	⅓ cup	4.6	131
Oyster stew	½ cup	4.2	118
Pea, split, no milk	½ cup	3.7	104
Tomato, clear	1 cup	8.8	250
cream	⅝ cup	3.2	90
Vegetable	½ cup	4.6	130
Vegetables			
Asparagus	25 stalks	14.7	417
Beans, Lima, dried	⅛ cup (½ c. cooked)	1.0	29
baked	½ cup, scant	3.0	85
snap, green	1¾ cups	8.8	250
Beets	3–2″ in diameter	7.4	208
Cabbage, raw, shredded	5 cups	14.7	417
Carrots	3–4 young	8.8	250
Cauliflower	1 medium head	12.7	360
Celery	4 cups diced	17.6	500
Corn, canned	½ cup	4.3	123
on the cob, medium	1 ear 4″ long		90
Cucumbers	6 medium (3 c. slices)	22.0	625
Lettuce	3 heads	22.0	624
Onions, raw	3–4	8.0	227
creamed	2 onions	3.0	85
Parsnips	½ cup, cubed	4.0	112
Peas, canned, drained	¾ cup	5.5	156
fresh, shelled	¾ cup	3.8	108
creamed	⅓ cup	2.6	74
Potatoes, baked	1 small	2.9	81
boiled	1 medium	4.4	125
creamed	⅖ cup	2.8	79
mashed	⅓ cup	2.2	63
Radishes, red	45 1″ in diameter	17.7	500
Spinach, cooked	2¼ cups	14.7	417

TABLE 3 (*Continued*)

100-CALORIE PORTIONS OF FOODS

	APPROXIMATE MEASURE CONTAINING 100 CALORIES	WEIGHT	
		OZ.	GM
Squash, winter, baked	1½ cups	10.9	280
Tomatoes, canned	2½ cups	17.7	500
raw	5 medium	17.7	500
Turnips, cooked	1¾ cups	11.0	312
Miscellaneous			
Candy, fudge	1″ cube	0.8	23
milk chocolate	1 piece 2¼″ x 1″ x ⅛″	0.7	19
Cream sauce	¼ cup	2.0	58
French dressing	2 tbsp.	0.6	17
Gravy, brown	½ cup	3.4	96
Honey	1½ tbsp.	1.1	31
Jam	1¾ tbsp.	1.2	36
Jelly	2 tbsp.	1.3	38
Macaroni, cooked	½ cup	3.8	108
with cheese	⅝ cup	2.5	70
Maple sirup	1½ tbsp.	1.4	39
Mayonnaise	1 tbsp.	0.5	14
Olives, ripe	6 medium	1.8	53
Sugar	1⅓ tbsp.	0.9	25

TABLE 4

SODIUM CONTENT OF FOODS *

Mg. per 100 Gm.

Fruits, Fresh

	MG.
Apples	10
Apricots	30
Avocados	67
Bananas	42
Berries, fresh	
Blackberries	4
Blueberries	16
Cranberries	6
Gooseberries	10
Huckleberries	16
Loganberries	2
Raspberries	3
Strawberries	7
Cantaloupe	43
Cherries	3
Currants	7
Figs	7
Grapefruit	4
Grapes	11
Lemons	13
Nectarines	9
Oranges	10
Peaches	15
Pears	8
Pineapple	14
Plums	4
Rhubarb	17
Watermelon	20

Fruits, Dried

	MG.
Currants	18
Dates	97
Figs	66
Peaches	6
Prunes	78
Raisins, seedless	87

Vegetables, Fresh

	MG.
Artichokes	25
Asparagus	16
Beans, snap or string	23
Beets	79
Broccoli	52
Brussels sprouts	8
Cabbage	32
Carrots	76
Cauliflower	41
Celery	130
Chard	86
Corn, sweet	40
Cucumbers	10
Dandelion greens	168
Eggplant	15
Endive and Escarole	60
Kale	52
Kohlrabi	50
Lettuce	30
Mushrooms	27
Mustard greens	48
Okra	15
Onions	1
Parsnips	8
Peas, fresh	19
Peppers, green	1
Potatoes, sweet	27
Potatoes, white	24
Pumpkin	54
Radishes	64
Spinach	84
Squash, summer	2
Squash, winter	4
Tomatoes	20
Tomato juice	15
Turnips	66
Turnip tops	45
Water cress	80

Legumes, Dried

	MG.
Beans, dried	103
Beans, lima	167
Lentils	57
Peas	89

Cereals and Breads

	MG.
Barley, pearled	56
Bread, white, salted	446
Bread, white, unsalted	12
Corn meal	39
Cornflakes	1,050
Farina	65
Flour, whole wheat	160
Flour, white	45
Flour, buckwheat	27
Flour, rye	19
Grapenuts	658
Macaroni, dry	18
Oatmeal, raw	71
Rice, polished, raw	28
Rice, boiled	2
Sago	3
Spaghetti (*See* Macaroni)	
Tapioca	4
Wheat, shredded	17

Table 4 (*Continued*)

SODIUM CONTENT OF FOODS *

Mg. per 100 Gm.

	MG.
Dairy Products	
Butter, salted	220
Butter, unsalted (sweet)	13
Cream, 40 per cent fat	30
Cheese, hard	80
Cheese, cottage, unsalted	34
Cheese, cream, unsalted	16
Milk, whole	51
Eggs, whole	140
white	170
yolk	56
Meats and Poultry	
Bacon	820
Beef, lean	84
Brain	147
Chicken (fowl)	91
Duck	195
Goose	145
Heart	153
Lamb, mutton	84
Liver	87
Pork, medium lean	69
Turkey	130
Veal, medium lean	89
Fish and Shellfish	
Bass	75
Bluefish	68
Clams	608
Codfish	96
Flounder	107
Haddock	66
Halibut	111
Mackerel	153
Oysters	471
Salmon	107
Trout, fresh water	88
Trout, sea	314
Nuts	
Almonds, unsalted	26
Brazil nuts, unsalted	26
Chestnuts	38
Coconut, dried	53
Peanuts, unsalted	39
Walnuts	23
Beverages	
Chocolate	68
Cocoa	59
Coffee, roasted	74
Coffee, infusion	1
Lemonade	Trace
Tea, dry	40
Tea, infusion	1
Wine, average	8
Condiments and Seasonings	
Curry powder	450
Ground ginger	34
Mustard	5
Pepper	7
Table salt	38,900
Vinegar	20
Miscellaneous	
Gelatin, plain	7
Honey	5
Jam, fruit	16
Maple sirup	11
Marmalade	18
Olives	1,189
Tobacco, chewing	1,600
Yeast, brewers', dry	18

* Compiled chiefly from Sherman, H. C.: Chemistry of Food and Nutrition, New York, Macmillan, 1946, with a few values from McCance, R. A., and E. M. Widdowson: The Chemical Composition of Foods, London, His Majesty's Stat. Off., 1940, and from miscellaneous sources.

TABLE 5

THE METABOLIC REACTION OF FOODS *

(Excess of either acid or base as cc. or milli-equivalents of normal acid or base per 100 Gm. of food. These figures are referred to as degree of acidity or alkalinity.)

FOOD	DEGREE OF ACIDITY
Meats, Fish, Poultry	
Beef, round, lean	10.6
Chicken, boiled	20.7
Cod, fresh	5.5
Halibut, fresh	9.4
Ham, boiled	10.0
Liver, beef, raw	10.1
Mackerel, fresh	9.3
Oysters	10.3
Pork, leg, roast	28.6
loin, roast	14.6
Salmon, fresh	11.0
Turkey, roast	19.5
Veal	13.5
Eggs, Cheese	
Eggs, whole	11.1
Cheese, Cheddar	5.5
cottage	4.5
Bread, Cake, Cereals, Crackers	
Bread, white	2.7
whole wheat	7.3
Cake, plain	4.3
Crackers, graham	8.5
soda	8.2
Corn meal, raw	6.5
Doughnuts	7.3
Oatmeal, raw	12.9
cooked	2.0
Rice, white, raw	7.6
cooked	2.6
Spaghetti, raw	9.6
cooked	2.1
Wheat meal, raw	12.0
Wheat, puffed	11.0
Nuts	
Peanut butter	4.4
Peanuts	11.6
Walnuts	8.4
Miscellaneous	
Corn, sweet	1.8
dried	6.0

FOOD	DEGREE OF ALKALINITY
Fruits	
Apples, raw	3.7
Apricots, raw	6.8
Bananas	5.6
Cantaloupe	7.5
Cranberries †	3.2
Dates	11.0
Grapes	2.7
Grapefruit	6.4
Lemons	5.5
Oranges	6.1
Peaches	5.0
Pears	3.3
Pineapple, fresh	6.8
Plums †	4.8
Prunes, stewed †	7.8
Raisins	23.7
Vegetables	
Beans, Lima, fresh	14.0
Navy, canned	6.4
dried	18.0
snap, fresh	5.4
Beets	10.9
Cabbage	6.0
Carrots	10.8
Celery	8.4
Potatoes, sweet	6.7
white	7.0
Spinach †	27.0
Squash, Hubbard	2.8
Tomatoes, fresh	5.6
Turnips	2.7
Milk	
Milk, fresh, whole	1.8
Buttermilk	2.2
Nuts	
Almonds	12.0
Miscellaneous	
Cocoa, beverage	2.9
Gingerbread	8.7

Neutral Foods

Butter
Cream
Cooking fats
Starches
Sugars
Sirups

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* Adapted from Bridges, M. A.: Dietetics for the Clinician. Philadelphia, Lea, 1941

† Ash alkaline in vitro, partly acid in vivo.

TABLE 6

FRUITS AND VEGETABLES

Classified According to Carbohydrate Content *

Group I 3 Per Cent Carbohydrate (For protein and fat content see below)	**Group II** 6 Per Cent Carbohydrate (For protein and fat content see below)	**Group III** 9 Per Cent Carbohydrate (For protein and fat content see below)
VEGETABLES Chiefly leafy, salad	VEGETABLES Chiefly green, yellow	VEGETABLES Chiefly roots, tubers
Asparagus, fresh and canned Beans, green and wax, canned Bean sprouts Cabbage, cauliflower, broccoli, sauerkraut Greens: beet, chard, mustard, spinach, turnip Salad vegetables: celery, chicory, cucumbers, endive, lettuce, radishes, romaine, tomatoes Squash, summer Tomato juice	Beans, snap and wax, fresh Carrots, canned Greens: collards, dandelion, kale Eggplant Okra Peppers, green and red, fresh Pumpkin Turnips, fresh	Artichokes, globe or French, fresh Beets, fresh and canned Brussels sprouts, fresh Carrots, fresh Onions, fresh Peas, fresh (very young) and canned Squash, winter Rutabagas, fresh
FRUITS †	FRUITS †	FRUITS †
Canned—w.p. Rhubarb Strawberries	*Canned*—w.p. Blackberries, gooseberries, peaches, plums, strawberries *Fresh* Melons: cantaloupe, casaba, honeydew, watermelon Strawberries	*Canned*—w.p. Applesauce, apricots, blackberries, blueberries, cherries, grapefruit, loganberries, pears, prunes, raspberries *Canned*—j.p. Peaches *Fresh* Blackberries, cranberries, gooseberries, grapefruit, tangerines
Protein Content Vegetables, 2 per cent Fruits, 1 per cent Fat content—negligible	Protein Content Vegetables, 2 per cent Fruits, 1 per cent Fat content—negligible	Protein Content Vegetables, 3 per cent Fruits, 1 per cent Fat content—negligible

TABLE 6 (*Continued*)

FRUITS AND VEGETABLES

Classified According to Carbohydrate Content

Group IV 12 Per Cent Carbohydrate	**Group V** 15 Per Cent Carbohydrate	**Group VI** 18 Per Cent Carbohydrate
VEGETABLES	VEGETABLES	VEGETABLES
Beans, Lima, canned	Beans, red kidney, canned Corn, sweet, very young Jerusalem artichoke, tubers Peas, fresh, med. mature Roots: parsnips, vegetable oyster (or salsify)	Corn, sweet, canned Potatoes, white Succotash, canned
FRUITS †	FRUITS †	FRUITS †
Canned—w.p. Figs, grapes, pineapple *Canned*—j.p. Applesauce, apricots, cherries, red and white; loganberries, pears, raspberries *Fresh* Apricots, cherries, sour Citrus: kumquats, oranges Berries: loganberries, raspberries Peaches, pineapple, plums *Juices* Apple, grapefruit, unsweetened; orange, pineapple	*Canned*—w.p. Cherries, black *Canned*—j.p. Pineapple *Fresh* Apples, blueberries, grapes, nectarines, pears *Juices* Blueberry, fresh	*Canned*—j.p. Cherries, black Prunes *Fresh* Cherries, sweet Figs, crabapples *Juices* Grape, fresh or bottled Prune, canned
Protein Content Vegetables, 5 per cent Fruits, 1 per cent Fat content—negligible	Protein Content Vegetables, 3 per cent Fruits, 1 per cent Fat content—negligible	Protein Content Vegetables, 3 per cent Fruits, 1 per cent Fat content—negligible

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* The above tables are based upon the classification given by Adams and Chatfield, J. Am. Dietet. A. **10**: 383, 1935, and Proximate Composition of American Food Materials, circular No. 549, U. S. Department of Agriculture, 1940.

† The canned fruits are either water-pack or juice-pack, designated as w.p. and j.p., respectively. The latter is slightly higher in carbohydrates.

Table 7

FOODS ARRANGED APPROXIMATELY ACCORDING TO CARBOHYDRATE CONTENT

E. P. Joslin *

Vegetables (fresh or canned)

5 per cent †		10 per cent †	15 per cent	20 per cent
1–3 per cent	3–5 per cent			
Lettuce	Tomatoes	String beans	Green peas	Potatoes
Cucumbers	Water cress	Pumpkin	Jerusalem artichokes	Shell beans
Spinach	Seakale	Turnip	Parsnips	Baked beans
Asparagus	Cauliflower	Squash	Lima beans (young)	Lima beans
Rhubarb	Eggplant	Beets		Green corn
Endive	Cabbage	Carrots		Boiled rice
Marrow	Radishes	Onions		Boiled macaroni
Sorrel	Leeks	Green peas (very young)		
Sauerkraut	String beans (very young)	Brussels sprouts		
Beet greens	Broccoli	Okra		
Dandelions	French artichokes			
Swiss chard	Green pepper			
Celery	Summer squash			
Mushrooms	Kohlrabi			

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* Joslin, E. P.: Diabetic Manual, Philadelphia, Lea, 1937.

† Reckon average carbohydrate in 5 per cent vegetables as 3 per cent; of 10 per cent as 6 per cent.

TABLE 8

EQUIVALENT WEIGHTS AND MEASURES

Weight Equivalents

	MILLIGRAM	GRAM	KILOGRAM	GRAIN	OUNCE	POUND
1 microgram (μg.) . . .	.001	.000001				
1 milligram (mg.) . . .	1.	.001		.0154		
1 gram (Gm.)	1,000.	1.	.001	**15.4**	.035	.0022
1 kilogram (Kg.)	1,000,000.	1,000.	1.	15,400.	35.2	2.2
1 grain (gr.)	64.8	.065		1.		
1 ounce (oz.)		**28.3**		437.5	1.	.063
1 pound (lb.)		**453.6**	.454		16.0	1.

Volume Equivalents

	CUBIC MILLIMETER	CUBIC CENTIMETER	LITER	FLUID OUNCE	PINT	QUART
1 cubic millimeter (cu. mm.) . . .	1.	.001				
1 cubic centimeter (cc.)	1,000.	1.	.001			
1 liter (L.)	1,000,000.	1,000.	1.	33.8	2.1	1.05
1 fluid ounce		**30.**(29.57)	.03	1.		
1 pint (pt.)		**473.**	.473	16.	1.	
1 quart (qt.)		946.	**.946**	32.	2.	1.

Linear Equivalents

	MILLIMETER	CENTIMETER	METER	INCH	FOOT	YARD
1 millimeter (mm.)	1.	.1	.001	.039	.00325	.0011
1 centimeter (cm.)	10.	1.		.39	.0325	.011
1 meter (M.)	1,000.	100.	1.	39.37	3.25	1.08
1 inch (in.)	25.4	**2.54**	.025	1.	.083	.028
1 foot (ft.)	304.8	30.48	.305	12.	1.	.33
1 yard (yd.)	914.4	91.44	.914	36.	3.	1.

Comparative Values of Weight and Volume of Water

1 liter = 1 kilo. = 2.2 lb.
1 fluid ounce = 30 Gm. = 1.04 oz.
1 pint = 473 Gm. = 1.04 lb.
1 quart = .946 kilo. = 2.1 lb.

Table of Common Measures and Metric Equivalents

1 tsp. = 5 cc.
1 tbsp. = 14 cc. (approx. 15 Gm.)
1 cup = 225 cc. (approx. 240 Gm.)

(See Table of Measures and Approximate Weights, p. 399)

Comparative Temperatures

	CENTIGRADE DEGREES	FAHRENHEIT DEGREES
Boiling water, sea level	100	212
Body temperature	37	98.6
Room temperature, average	20	70
Freezing	0	32

TABLE 9

VALUES USED IN NUTRITION CALCULATIONS

Certain numerical values and constants are essential tools for the physician, the dietitian and the nurse. Those given on this page are commonly used in dietary calculations. For further details on them and on minerals and vitamins, see Recommended Dietary Allowances, Chapter 11.

Normal Dietary Requirements

	ADULTS		CHILDREN	
	GM./KILO	PER CENT OF TOTAL CALORIES	GM./KILO	PER CENT OF TOTAL CALORIES
Protein	⅔–1½	10–15	2–3½	20
Fat	1–2	30–40	2–3	30
Carbohydrate	4–6	50–60	6–10	50

Calories (per kilo of normal wt.)

Basal rate	24 (1 cal/kilo/hr.)	Under 1 yr.	100
Bed rest	25–30	1–3 yr.	100–90
Light exercise	25–40	4–6 yr.	90–80
Moderate exercise	40–50	7–12 yr.	80–60
Heavy muscular work	50–60	Girls 13–20 yr.	60–45
		Boys 13–20 yr.	70–60

Numerical Constants Pertaining to Food Values

	PROTEIN	FAT	CARBOHYDRATE
Calorie value per gram in a mixed diet	4	9	4
Respiratory quotient (R.Q.)	0.8	0.7	1.0
Glucogenic fraction	58 per cent	10 per cent	100 per cent
Ketogenic fraction	46 per cent	90 per cent	. . .

TABLE 10

BLOOD CONSTITUENTS *

	NORMAL RANGE	DEVIATIONS IN DISEASE	
		DECREASED	INCREASED
Hematology			
Red blood cells (Erythrocytes)	4.5–5 millions per cu. mm.	Anemia Hemorrhage Chronic infectious diseases Prolonged dietary deficiency of iron	Polycythemia Dehydration
White blood cells (Leukocytes)	5–10 thousands per cu. mm.	Leukopenia	Acute infections Leukemias
Hemoglobin	16 grams per cent	Anemias	Polycythemia Dehydration
Hematocrit	$\frac{\text{Red cells}}{\text{Serum}}$ = 42–46% cells	Anemia	Polycythemia
Chemistry			
Sugar	80–110 mg./100 cc.	Hyperinsulinism Addison's disease	Diabetes mellitus Cushing's syndrome
Nonprotein nitrogen	under 30 mg./100 cc.		Dehydration Renal disease
Uric acid	under 6 mg./100 cc.		Gout Nephritis
Urea nitrogen	under 25 mg./100 cc.		Renal disease
Creatinine	under 2 mg./100 cc.		Renal disease
Protein	6.5–7.5 Gm./100 cc.	Nephrosis Nephritis with edema	Multiple myeloma
Calcium	9.5–11 mg./100 cc.	Renal disease Hypoparathyroidism Chronic rickets Steatorrhea	Hyperparathyroidism Multiple myeloma
Potassium	4.5 m.eq/liter	Periodic paralysis	Addison's disease Renal disease
Sodium	140 m.eq/liter	Diabetic acidosis Addison's disease Diarrhea	Dehydration
Phosphorus	3–4 mg./100 cc.	Rickets Renal disease Hyperparathyroidism	Hypoparathyroidism Renal disease
Chloride	103 m.eq/liter	Renal disease Addison's disease Dehydration	Dehydration Renal disease
Total base	152 m.eq/liter	Diabetic acidosis Addison's disease Diarrhea	

TABLE 10 (*Continued*)

BLOOD CONSTITUENTS *

		DEVIATIONS IN DISEASE	
	NORMAL RANGE	DECREASED	INCREASED
Chemistry (*Continued*)			
Cholesterol	under 200 mg./100 cc.	Pernicious anemia Malnutrition Hyperthyroidism	Pregnancy Biliary obstruction Myxedema Uncontrolled diabetes Renal disease
Bilirubin	under 0.5 mg./100 cc.		Jaundice
Phosphatase	3–5 units/100 cc.	Retarded growth	Certain bone diseases
Vitamin C	0.5–1.4 mg./100 cc.	Infection Dietary deficiency	
Vitamin A	40–100 I.U./100 cc.	Cirrhosis Infectious hepatitis Myxedema Malnutrition	
Carbon dioxide	27 m.eq/liter	Acidosis	Alkalosis

* Diet Manual of the Massachusetts General Hospital, 1946.

Table 11

AVERAGE WEIGHT FOR HEIGHT TABLES *

For Girls from Birth to School Age †

HEIGHT (IN.)	1 MO.	3 MOS.	6 MOS.	9 MOS.	12 MOS.	18 MOS.	24 MOS.	30 MOS.	36 MOS.	48 MOS.	60 MOS.	72 MOS.
20	8											
21	9	10										
22	10	11										
23	11	12	13									
24	12	13	14	14								
25	13	14	15	15								
26	..	15	16	17	17							
27	..	16	17	18	18							
28	..	..	19	19	19	19						
29	..	..	19	20	20	20						
30	..	..	21	21	21	21	21					
31	..	..	..	22	22	23	23	23				
32	..	..	..	..	23	24	24	24	25			
33	..	..	..	..	..	25	25	25	26			
34	..	..	..	..	..	26	26	26	27			
35	..	..	..	..	..	29	29	29	29	29		
36	..	..	..	..	..	..	30	30	30	30	31	
37	..	..	..	..	..	..	31	31	31	31	32	
38	..	..	..	..	..	..	..	33	33	33	33	
39	..	..	..	..	..	..	..	34	34	34	34	34
40	..	..	..	..	..	..	..	..	35	36	36	36
41	..	..	..	..	..	..	..	..	..	37	37	37
42	..	..	..	..	..	..	..	..	..	39	39	39
43	..	..	..	..	..	..	..	..	..	40	41	41
44	..	..	..	..	..	..	..	..	..	..	42	42
45	..	..	..	..	..	..	..	..	..	..	..	45
46	..	..	..	..	..	..	..	..	..	..	..	47
47	..	..	..	..	..	..	..	..	..	..	..	50
48	..	..	..	..	..	..	..	..	..	..	..	52

TABLE 11 (*Continued*)

AVERAGE WEIGHT FOR HEIGHT TABLES *

For Boys from Birth to School Age †

HEIGHT (IN.)	1 MO.	3 MOS.	6 MOS.	9 MOS.	12 MOS.	18 MOS.	24 MOS.	30 MOS.	36 MOS.	48 MOS.	60 MOS.	72 MOS.
20	8											
21	9	10										
22	10	11										
23	11	12	13									
24	12	13	14									
25	13	14	15	16								
26	. .	15	17	17	18							
27	. .	16	18	18	19							
28	. .	. .	19	19	20	20						
29	. .	. .	20	21	21	21						
30	. .	. .	22	22	22	22	22					
31	. .	. .	. .	23	23	23	23	24				
32	. .	. .	. .	24	24	24	25	25				
33	. .	. .	. .	. .	26	26	26	26	26			
34	. .	. .	. .	. .	. .	27	27	27	27			
35	. .	. .	. .	. .	. .	29	29	29	29	29		
36	. .	. .	. .	. .	. .	. .	30	31	31	31		
37	. .	. .	. .	. .	. .	. .	32	32	32	32	32	
38	. .		. .	. .				33	33	33	34	
39	. .		. .	. .	. .			35	35	35	35	
40			. .	. .	. .				36	36	36	36
41			. .	. .	. .	. .				38	38	38
42					. .	. .				39	39	39
43					. .	. .				41	41	41
44						. .					43	43
45											45	45
46												48
47												50
48												52
49												55

TABLE 11 (*Continued*)

AVERAGE WEIGHT FOR HEIGHT TABLES *

For Girls from 5 to 18 Years ‡

HEIGHT (IN.)	5 YRS.	6 YRS.	7 YRS.	8 YRS.	9 YRS.	10 YRS.	11 YRS.	12 YRS.	13 YRS.	14 YRS.	15 YRS.	16 YRS.	17 YRS.	18 YRS.
38	33	33												
39	34	34												
40	36	36	36											
41	37	37	37											
42	39	39	39											
43	41	41	41	41										
44	42	42	42	42										
45	45	45	45	45	45									
46	47	47	47	48	48									
47	49	50	50	50	50	50								
48	. .	52	52	52	52	53	53							
49	.	54	54	55	55	56	56							
50		56	56	57	58	59	61	62						
51			59	60	61	61	63	65						
52			63	64	64	64	65	67						
53			66	67	67	68	68	69	71					
54			. .	69	70	70	71	71	73					
55			. .	72	74	74	74	75	77	78				
56					76	78	78	79	81	83				
57					80	82	82	82	84	88	92			
58					. .	84	86	86	88	93	96	101		
59					. .	87	90	90	92	96	100	103	104	
60					. .	91	95	95	97	101	105	108	109	111
61					. .	. .	99	100	101	105	108	112	113	116
62					. .	. .	104	105	106	109	113	115	117	118
63							.	110	110	112	116	117	119	120
64							.	114	115	117	119	120	122	123
65							. . .	118	120	121	122	123	125	126
66							. . .	. . .	124	124	125	128	129	130
67								. .	128	130	131	133	133	135
68								. . .	131	133	135	136	138	138
69								. . .	. .	135	137	138	140	142
70										136	138	140	142	144
71										138	140	142	144	145

TABLE 11 (*Continued*)

AVERAGE WEIGHT FOR HEIGHT TABLES *

For Boys from 5 to 19 Years ‡

HEIGHT (IN.)	5 YRS.	6 YRS.	7 YRS.	8 YRS.	9 YRS.	10 YRS.	11 YRS.	12 YRS.	13 YRS.	14 YRS.	15 YRS.	16 YRS.	17 YRS.	18 YRS.	19 YRS.
38	34	34													
39	35	35													
40	36	36													
41	38	38	38												
42	39	39	39	39											
43	41	41	41	41											
44	44	44	44	44											
45	46	46	46	46	46										
46	47	48	48	48	48										
47	49	50	50	50	50	50									
48	..	52	53	53	53	53									
49	..	55	55	55	55	55	55								
50	..	57	58	58	58	58	58	58							
51	..	..	61	61	61	61	61	61							
52	..	..	63	64	64	64	64	64	64						
53	..	..	66	67	67	67	67	68	68						
54	..	..	..	70	70	70	70	71	71	72					
55	..	..	..	72	72	73	73	74	74	74					
56	..	..	..	75	76	77	77	77	78	78	80				
57	..	..	..	..	79	80	81	81	82	83	83				
58	..	..	..	..	83	84	84	85	85	86	87				
59	..	..	..	..	..	87	88	89	89	90	90	90			
60	..	..	..	..	..	91	92	92	93	94	95	96			
61	..	..	..	..	..	..	95	96	97	99	100	103	106		
62	..	..	..	..	..	..	100	101	102	103	104	107	111	116	
63	..	..	..	..	..	..	105	106	107	108	110	113	118	123	127
64	..	..	..	..	..	..	...	109	111	113	115	117	121	126	130
65	..	..	..	..	..	..	...	114	117	118	120	122	127	131	134
66	..	..	..	..	..	..	...	...	119	122	125	128	132	136	139
67	..	..	..	..	..	..	...	...	124	128	130	134	136	139	142
68	..	..	..	..	..	..	...	...	...	134	134	137	141	143	147
69	..	..	..	..	..	..	...	...	...	137	139	143	146	149	152
70	..	..	..	..	..	..	...	...	...	143	144	145	148	151	155
71	..	..	..	..	..	..	...	...	...	148	150	151	152	154	159
72	..	..	..	..	..	..	...	...	...	...	153	155	156	158	163
73	..	..	..	..	..	..	...	...	...	...	157	160	162	164	167
74	..	..	..	..	..	..	...	...	...	...	160	164	168	170	171

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* Metropolitan Life Insurance Company.

† Prepared by Robert M. Woodbury, Ph.D., Children's Bureau, U. S. Dept. of Labor.

‡ Prepared by Bird T. Baldwin, Ph.D., and Thomas D. Wood, M.D.

TABLE 12

HEIGHT-WEIGHT TABLES FOR MEN AND WOMEN

COMPARATIVE SIGNIFICANCE OF IDEAL VS. AVERAGE WEIGHTS FOR ADULTS

Tables of average weight for height for men and women at different ages, compiled by insurance companies from their records, were formerly used as the only guides to desirable weight. Evaluation of their statistics in terms of health and longevity disclosed that it was more advantageous to be slightly overweight under 30 and underweight over 30 as compared with average figures.

More recently the Metropolitan Life Insurance Co., after years of research, has published tables of ideal weights for adults which recognize differences in frame but do not allow for increases with age. The older tables of *average* weights at different ages are given along with those of *ideal* weights for comparison. It should be recognized, however, that control of body weight in line with the *ideal* rather than the *average* is more compatible with health and longevity.

IDEAL WEIGHTS FOR WOMEN, AGES 25 AND OVER *

HEIGHT (WITH SHOES)		WEIGHT IN POUNDS (AS ORDINARILY DRESSED)		
FT.	IN.	SMALL FRAME	MEDIUM FRAME	LARGE FRAME
4	11	104–111	110–118	117–127
5	0	105–113	112–120	119–129
5	1	107–115	114–122	121–131
5	2	110–118	117–125	124–135
5	3	113–121	120–128	127–138
5	4	116–125	124–132	131–142
5	5	119–128	127–135	133–145
5	6	123–132	130–140	138–150
5	7	126–136	134–144	142–154
5	8	129–139	137–147	145–158
5	9	133–143	141–151	149–162
5	10	136–147	145–155	152–166
5	11	139–150	148–158	155–169

TABLE 12 (*Continued*)

IDEAL WEIGHTS FOR MEN. AGES 25 AND OVER *

HEIGHT (WITH SHOES)		WEIGHT IN POUNDS (AS ORDINARILY DRESSED)		
FT.	IN.	SMALL FRAME	MEDIUM FRAME	LARGE FRAME
5	2	116–125	124–133	131–142
5	3	119–128	127–136	133–144
5	4	122–132	130–140	137–149
5	5	126–136	134–144	141–153
5	6	129–139	137–147	145–157
5	7	133–143	141–151	149–162
5	8	136–147	145–156	153–166
5	9	140–151	149–160	157–170
5	10	144–155	153–164	161–175
5	11	148–159	157–168	165–180
6	0	152–164	161–173	169–185
6	1	157–169	166–178	174–190
6	2	163–175	171–184	179–196
6	3	168–180	176–189	184–202

TABLE 12 (*Continued*)

STANDARD TABLE OF HEIGHTS AND WEIGHTS *

WOMEN

Lightface Figures are 20 Per Cent Under and Over the Average

HEIGHTS		WEIGHTS ACCORDING TO AGE PERIOD								
FT.	IN.	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59
4	11	88 **110** 132	90 **113** 136	93 **116** 139	95 **119** 143	98 **122** 146	101 **126** 151	103 **129** 155	105 **131** 157	106 **132** 158
5	0	90 **112** 134	92 **115** 138	94 **118** 142	97 **121** 145	99 **124** 149	102 **128** 154	105 **131** 157	106 **133** 160	107 **134** 161
	1	91 **114** 137	94 **117** 140	96 **120** 144	98 **123** 148	101 **126** 151	104 **130** 156	106 **133** 160	108 **135** 162	110 **137** 164
	2	94 **117** 140	96 **120** 144	98 **122** 146	100 **125** 150	103 **129** 155	106 **133** 160	109 **136** 163	110 **138** 166	112 **140** 168
	3	96 **120** 144	98 **123** 148	100 **125** 150	102 **128** 154	106 **132** 158	109 **136** 163	111 **139** 167	113 **141** 169	114 **143** 172
	4	98 **123** 148	101 **126** 151	103 **129** 155	106 **132** 158	109 **136** 163	111 **139** 167	114 **142** 170	115 **144** 173	117 **146** 175
	5	101 **126** 151	103 **129** 155	106 **132** 158	109 **136** 163	112 **140** 168	114 **143** 172	117 **146** 175	118 **148** 178	120 **150** 180
	6	104 **130** 156	106 **133** 160	109 **136** 163	112 **140** 168	115 **144** 173	118 **147** 176	121 **151** 181	122 **152** 182	122 **153** 184
	7	107 **134** 161	110 **137** 164	112 **140** 168	115 **144** 173	118 **148** 178	121 **151** 181	124 **155** 186	126 **157** 188	126 **158** 190
	8	110 **138** 166	113 **141** 169	115 **144** 173	118 **148** 178	122 **152** 182	124 **155** 186	127 **159** 191	130 **162** 194	130 **163** 196
	9	113 **141** 169	116 **145** 174	118 **148** 178	122 **152** 182	125 **156** 187	127 **159** 191	130 **163** 196	133 **166** 199	134 **167** 200

TABLE 12 (*Continued*)

STANDARD TABLE OF HEIGHTS AND WEIGHTS *

WOMEN (*Continued*)

Lightface Figures are 20 Per Cent Under and Over the Average

HEIGHTS		WEIGHTS ACCORDING TO AGE PERIOD								
FT.	IN.	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59
5	10	116 **145** 174	119 **149** 179	122 **152** 182	124 **155** 186	127 **159** 191	130 **162** 194	133 **166** 199	136 **170** 204	138 **173** 208
	11	120 **150** 180	122 **153** 184	124 **155** 186	126 **158** 190	130 **162** 194	133 **166** 199	136 **170** 204	139 **174** 209	142 **177** 212
6	0	124 **155** 186	126 **157** 188	127 **159** 191	130 **162** 194	132 **165** 198	135 **169** 203	138 **173** 208	142 **177** 212	146 **182** 218

TABLE 12 (*Continued*)

STANDARD TABLE OF HEIGHTS AND WEIGHTS *

MEN

Lightface Figures are 20 Per Cent Under and Over the Average

HEIGHTS		WEIGHTS ACCORDING TO AGE PERIOD								
FT.	IN.	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55-59
4	11	89 **111** 133	94 **117** 140	98 **122** 146	100 **125** 150	102 **127** 152	104 **130** 156	106 **132** 158	106 **133** 160	107 **134** 161
5	0	90 **113** 136	95 **119** 143	99 **124** 149	102 **127** 152	103 **129** 155	106 **132** 158	107 **134** 161	108 **135** 162	109 **136** 163
	1	92 **115** 138	97 **121** 145	101 **126** 151	103 **129** 155	105 **131** 157	107 **134** 161	109 **136** 163	110 **137** 164	110 **138** 166
	2	94 **118** 142	99 **124** 149	102 **128** 154	105 **131** 157	106 **133** 160	109 **136** 163	110 **138** 166	111 **139** 167	112 **140** 168
	3	97 **121** 145	102 **127** 152	105 **131** 157	107 **134** 161	109 **136** 163	111 **139** 167	113 **141** 169	114 **142** 170	114 **143** 172
	4	99 **124** 149	105 **131** 157	107 **134** 161	110 **137** 164	112 **140** 168	114 **142** 170	115 **144** 173	116 **145** 174	117 **146** 175
	5	102 **128** 154	108 **135** 162	110 **138** 166	113 **141** 169	115 **144** 173	117 **146** 175	118 **148** 178	119 **149** 179	120 **150** 180
	6	106 **132** 158	111 **139** 167	114 **142** 170	116 **145** 174	118 **148** 178	120 **150** 180	122 **152** 182	122 **153** 184	123 **154** 185
	7	109 **136** 163	114 **142** 170	117 **146** 175	119 **149** 179	122 **152** 182	123 **154** 185	125 **156** 187	126 **157** 188	126 **158** 190
	8	112 **140** 168	117 **146** 175	120 **150** 180	123 **154** 185	126 **157** 188	127 **159** 191	129 **161** 193	130 **162** 194	130 **163** 196
	9	115 **144** 173	120 **150** 180	123 **154** 185	126 **158** 190	130 **162** 194	131 **164** 197	133 **166** 199	134 **167** 200	134 **168** 202

TABLE 12 (*Continued*)

STANDARD TABLE OF HEIGHTS AND WEIGHTS *

MEN (*Continued*)

Lightface Figures are 20 Per Cent Under and Over the Average

HEIGHTS		WEIGHTS ACCORDING TO AGE PERIOD								
FT.	IN.	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59
5	10	118	123	126	130	134	135	137	138	138
		148	**154**	**158**	**163**	**167**	**169**	**171**	**172**	**173**
		178	185	190	196	200	203	205	206	208
	11	122	126	130	134	138	140	142	142	143
		153	**158**	**163**	**168**	**172**	**175**	**177**	**178**	**179**
		184	190	196	202	206	210	212	214	215
6	0	126	130	135	139	142	145	146	147	148
		158	**163**	**169**	**174**	**178**	**181**	**183**	**184**	**185**
		190	196	203	209	214	217	220	221	222
	1	130	134	140	144	147	150	152	153	154
		163	**168**	**175**	**180**	**184**	**187**	**190**	**191**	**192**
		196	202	210	216	221	224	228	229	230
	2	134	138	145	149	153	155	158	158	159
		168	**173**	**181**	**186**	**191**	**194**	**197**	**198**	**199**
		202	208	217	223	229	233	236	238	239
	3	138	142	150	154	158	161	163	164	165
		173	**178**	**187**	**192**	**197**	**201**	**204**	**205**	**206**
		208	214	224	230	236	241	245	246	247

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* Metropolitan Life Insurance Company, Statistical Bureau.

TABLE 13

HEALTH SCORE CARD *

OBSERVE OR CONSIDER	NORMAL CONDITIONS	ABNORMAL CONDITIONS
Appetite	Ready for meals, taking pleasure in eating health-building foods	Excessively interested in food; disliking many foods; craving sweets
Breathing	Deep; regular; with mouth closed and breath sweet	Shallow; irregular; with mouth open; short-winded on slight exertion; with offensive odor to breath
Color	Of mucous membranes, ears, cheeks, lips, and fingernails, pink—pink glow to skin on all parts of body	Of mucous membranes, ears, cheeks, lips and nails—pale
Digestion	Good, as shown by complete unawareness of digestion	Poor, as shown by belching, gas, indigestion, car sickness, occasional nausea, vomiting
Disposition	Cheerful, pleasant, even-tempered in times of stress	Surly, irritable, grouchy, un-co-operative, quick to anger
Elimination	Once daily; with feces formed, soft, moist, free from odor; without laxatives	Irregular; with feces hard, dry, not formed; having offensive odor; obtained with use of laxatives
Eyes	Bright; free from underlying circles; not sensitive to light; having a direct, alert glance; without frowning or squinting	Dull; with underlying circles; sensitive to bright light; with frowning, squinting, shifting glance
Facial expression	Radiating health whether animated or in repose; relaxed, showing happiness and courage	Strained, tense, drawn; showing fatigue, worry, sadness
Gums	Smooth; fitting tightly at the base of each tooth; free from bleeding	Puffy; swollen, sore; bleeding easily; withdrawn from base of tooth
Hair	Glossy, lustrous, alive; with scalp clean, pink, free from dandruff	Coarse, dull, lifeless, falling, thin, too oily; with scalp pale in color, scaly, dry, dandruffy
Hands	Free from tremor; with palms slightly yellow; with nails strong, not easily broken, smooth	Showing tremor of fingers; with palms white or bluish; with nails which peel, break easily, or are ridged
Heart	Steady (about 72 beats per minute); with strong, steady regular beats; without the person being aware of the heart beat	Weak or irregular beat (resting pulse either above or below 72); with person aware of his heart beat
Mental ability	Alert, mentally eager; able to concentrate and think clearly	Having sluggish thought processes; lacking intellectual eagerness; disinterested; forgetful; unable to concentrate
Mental outlook	Forward looking, courageous; unafraid, eager to attack any problem	Apprehensive; easily depressed; disinterested; fearful of life
Moral outlook	Honest, courageous, fearless, willing to fight for what is right	Afraid to stand for what is right; wanting something for nothing; cheating whenever possible

TABLE 13 (*Continued*)

HEALTH SCORE CARD *

OBSERVE OR CONSIDER	NORMAL CONDITIONS	ABNORMAL CONDITIONS
Muscle tone	So firm that erect posture is unconsciously maintained	Soft, flabby; unable to stand erect unless muscles are tensed
Neck	Having no enlargement; with ligaments clearly seen on turning head	With fullness on either side of windpipe indicating enlarged thyroid glands
Nerves	Steady, relaxed, permitting person to sleep easily	Tense, irritable, unstable, flighty; causing person to bite fingernails and have difficulty in sleeping
Posture:		
Abdomen	Flat because of contraction of vertical abdominal muscles anchored to raised sternum	Protruding, sagging
Chest	High, well rounded; with raised sternum	Hollow, sagging
Feet	Directly forward; with weight distributed evenly on both feet, and body supported 60 per cent on ball of foot, 40 per cent on heel	Toeing either in or out; with too much weight on heel or small toe border
Head	Carried high; with ear on direct line with shoulder, hip, knee, and ankle joints; with chin at right angle to head; with back of neck in straight line from shoulders	Thrown forward or too far back; with chin sagging or too high; with back of neck curved into a U
Hips	With buttocks down and forward; with pelvic bones forming support for internal organs; in profile, hip joint directly above knee and ankle joints	With buttocks too far back and carried high, and pelvic bone tipped forward so that internal organs are not supported
Legs	Straight and at right angles to feet; with knee caps directly forward	With knee caps turned outward; with lower leg circling out and back from ankle
Shoulders	Flattened into perpendicular plane; with shoulder tips back	Rounded; with shoulder tips forward
Resistance to infections	Freedom from all infections and illness	Susceptible to infections and illness of any kind
Skin	Smooth, turgent, soft, slightly moist, faintly pink, free from bruises, even after severe blows	Pale in color, dry, scaly, oily, with blemishes such as rashes, blackheads, white heads, boils, bruising easily
Skeletal development:		
Chest	Broad, rounded; with each rib under the one above	Having pigeon chest, with narrow cavity and lower ribs flaring out
Face	Well developed, proportionate with forehead flat with relation to face	With narrow cheek bones, overhanging or underdeveloped forehead, and chin either receding or prominent

TABLE 13 (*Continued*)

HEALTH SCORE CARD *

OBSERVE OR CONSIDER	NORMAL CONDITIONS	ABNORMAL CONDITIONS
Joints	Without enlargements	With enlargements causing knock-knees, bowed legs, and enlarged wrists
Mouth	Having rounded arch and teeth well spaced	Having teeth crowded together, narrow arch, and protruding, badly aligned teeth
Step	Elastic, rhythmical; with body so well balanced as to make step silent	Shuffling, waddling; with body so out of balance as to make step heavy
Teeth	Immune to decay	Showing active decay
Vitality	Energetic; possessing stamina and endurance	Listless, tiring easily; lacking endurance; sluggish of movement; possessing nervous energy rather than vitality
Weight	Correct for age and height	Underweight or overweight according to individual standards

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* Davis, A.: Vitality Through Planned Nutrition, New York: The Macmillan Company, 1944.

Special Tests

PROCEDURES CONCERNED WITH DIABETES MELLITUS

Simple Tests for Sugar and Diacetic Acid in the Urine

The urine of a diabetic is likely to contain appreciable amounts of those products which the body cannot metabolize. For this reason urinary tests are a convenient criterion for judging the severity of the disease or the success of its treatment. The nurse and the patient should both know how to make simple tests for sugar and diacetic acid. Sometimes these are made on samples of urine taken from a single voiding, sometimes on a 24-hour specimen. It is usually more significant for the physician to know at what hours of the day sugar is being passed in order that he may adjust the insulin dosage accordingly. Urine from normal individuals and from diabetics on proper insulin dosage contains no sugar or diacetic acid.

COLLECTION OF URINE

24-hour specimen

The urine voided at 7 A.M. should be discarded. All urine voided during the following 24 hours up to and including that at 7 A.M. the next morning should be collected in a glass jar and kept in a cool place. A two-quart Mason jar is convenient. One teaspoonful of toluol may be added as a preservative.

Periodic specimens

The physician may request a sugar test on urine voided before and after meals or at certain times of the day. In this case the samples are kept separately and preferably tested immediately.

BENEDICT QUALITATIVE TEST FOR SUGAR

Equipment necessary

Test tubes—3 or more
Teaspoon
Medicine dropper
Gas burner or alcohol lamp
Benedict's qualitative solution

Directions for the test

Place 5 cc. (1 teaspoonful) of Benedict's solution in a test tube and add exactly 8 drops of the urine to be tested. Shake gently and heat over a free flame, allowing it to boil 1 minute. The tube may be heated in vigorously boiling water for 5 minutes with the same results. Allow the tube to cool spontaneously. The following color reactions indicate the amount of sugar present.

Clear blue: No change from the original solution = "sugar-free"
Green: Slight sediment on standing = trace of sugar present
Yellow or yellowish green: Yellow sediment = a few tenths per cent of sugar
Red or reddish brown: Heavy sediment = more than 1 per cent of sugar present

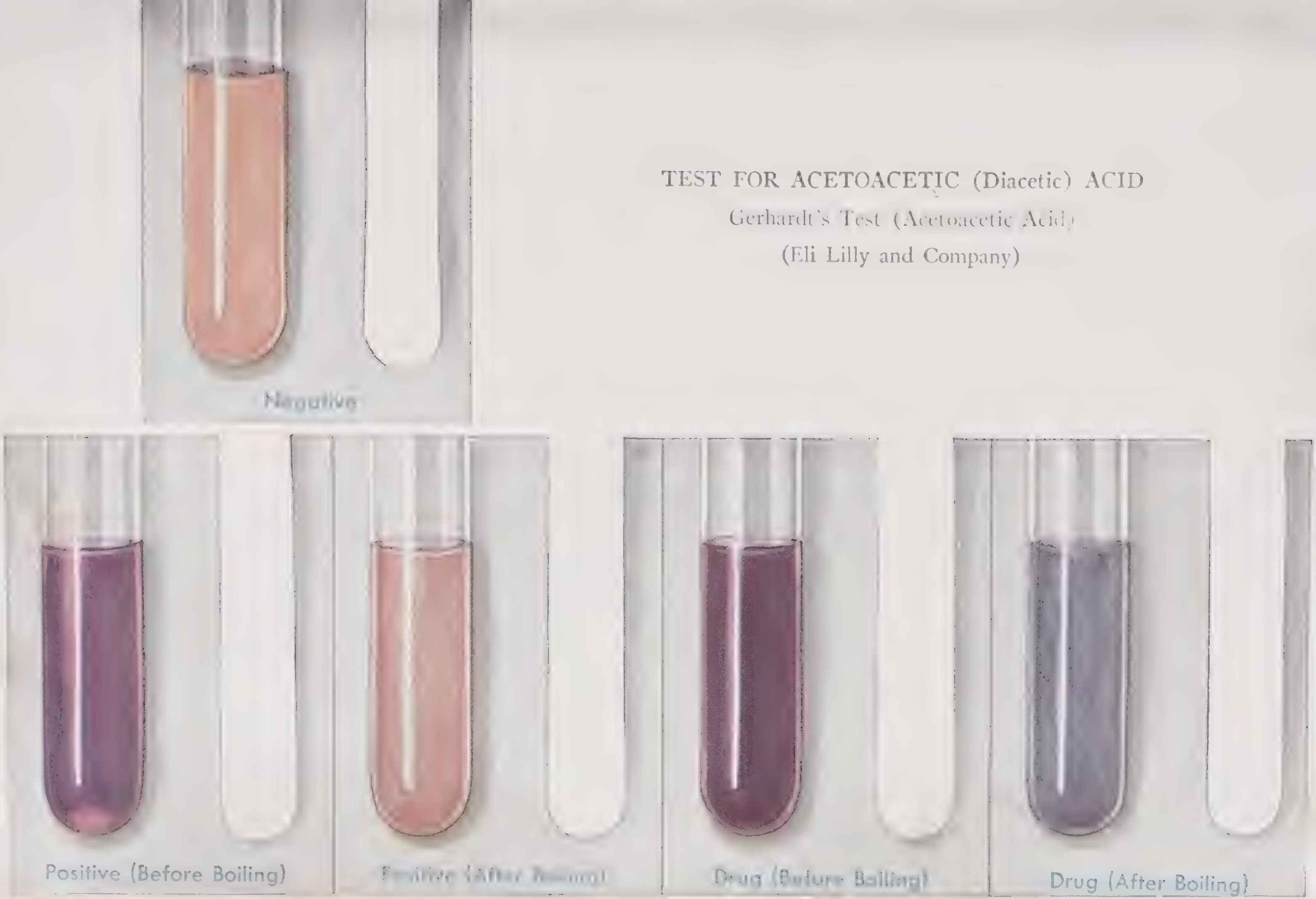
Test tubes must be cleaned thoroughly after each test. A test-tube brush will be most convenient for this purpose.

Benedict's qualitative solution may be purchased from hospital laboratories, drugstores or diabetic supply houses, or may be made according to the following directions:

TEST FOR ACETOACETIC (Diacetic) ACID

Gerhardt's Test (Acetoacetic Acid)

(Eli Lilly and Company)



BENEDICT'S SOLUTION	Gm. or cc.
Copper sulfate (pure crystallized)	17.3
Sodium or potassium citrate	173.0
Sodium carbonate, crystallized. (If the anhydrous sodium carbonate is used, only one half of this amount should be taken)	200.0
Distilled water, to make	1000.0

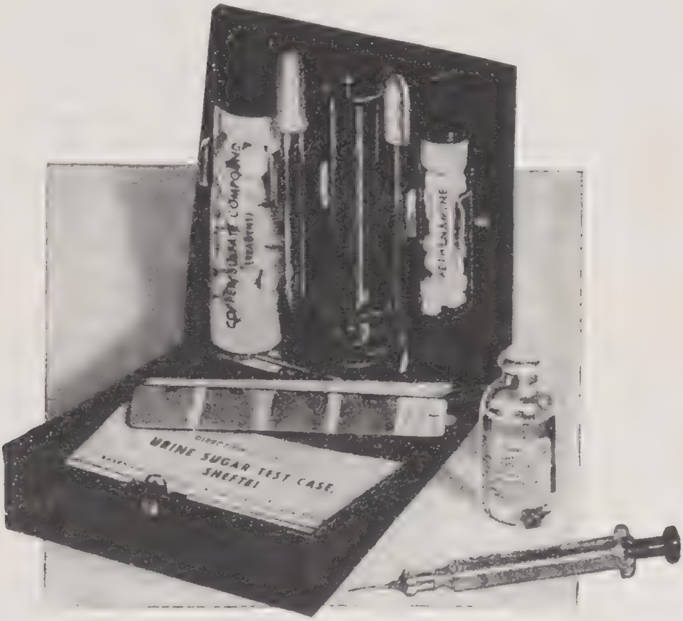

COPPER SULFATE COMPOUND (REAGENT)
URINE SUGAR TEST CASE, SHEFTEL

Fig. 128. Sheftel set for home or emergency use. This set is designed for rapid estimation of the amount of sugar in the urine. It is accurate enough for clinical purposes. The directions contained in the folder which accompanies the set are clear and easy to follow. (Eli Lilly and Co.)

The citrate and the carbonate are dissolved together with the aid of heat in about 700 cc. of water. The mixture is poured (through a filter, if necessary) into a large beaker. The copper sulfate is dissolved separately in about 100 cc. of water and is poured slowly into the first solution, with constant stirring. The mixture is cooled and diluted to 1 liter. This solution will keep indefinitely.

A practical modification of the Benedict test is available in the Sheftel Kit. It is easily portable and provides an accurate bedside method for home and office use.

GERHARDT'S TEST FOR DIACETIC ACID

Diacetic acid is only one of the three abnormal products which may appear in the urine as a result of the incomplete utilization of fat. It is the simplest one to detect.

Directions for the test

To about 10 cc. of fresh urine in a test tube carefully add a few drops of a concentrated solution of ferric chloride, one drop at a time. A wine-red color indicates the presence of diacetic acid. Continue adding the ferric chloride until no further deepening of color is evident. If the color is due to diacetic acid, it will fade upon heating, but if due to certain drugs, it will persist. Pour a portion of the red solution into a second test tube and heat in boiling water for 5 minutes. Compare the two tubes to determine whether the color has faded.

DIRECTIONS FOR THE ADMINISTRATION OF INSULIN

Insulin cannot be given by mouth because it is destroyed by the digestive secretions; it must be given by means of a hypodermic needle and a syringe subcutaneously and not intramuscularly. Insulin should be administered from 15 to 30 minutes before meals as a rule, but under special conditions it is better that it be given after the food has been taken and retained.

Insulin is sold in small rubber-capped vials labeled plainly as to the number of units of insulin in 1 cc. of the solution. (One cc. of U 10 contains 10 units, 1 cc. of U 20 contains 20 units.) Read the label carefully and follow accurately the physician's instructions as to dosage.

An insulin syringe is usually of 1-2 cc. capacity, graduated in tenths of cc. or in units. It has been found practical and safe to use a syringe graduated in units to correspond with the strength of insulin used; thus, U 40 insulin is used with a syringe graduated to U 40 only and without a double graduation. The syringe and the hypodermic needle must be sterile to avoid infection.

It has also been found practical to use a needle about ⅝ inch in length with a metal stop a short distance from the hub. These are special insulin needles and their use avoids the danger of the loss of the needle in the flesh if it should break.

A. Sterilization

1. Wash the hands thoroughly with soap and water.

2. Place the separate parts of the syringe and the needle in pan with water. It is a good plan to wrap each piece in a small piece of cloth.

3. Boil 5 minutes.

4. Pour off water or lift out tray containing the syringe and allow to cool by standing.

5. Optional method: Keep separate parts of the syringe and needle in pure alcohol when not in use. They should be carefully washed after each injection. This method should be used only on the advice of a physician.

6. Paint the top of the insulin vial with 95 per cent pure alcohol.

B. Loading the Syringe

1. Insert piston into the barrel without touching the cylinder of the piston. Remove the wire from the needle and fit the needle firmly onto the barrel. Draw out the piston so that the syringe contains a small amount of air.

2. Push the needle through the rubber cap of the insulin bottle until the point is just visible.

3. Invert the bottle and force air into the bottle.

4. Withdraw a trace more insulin than is needed.

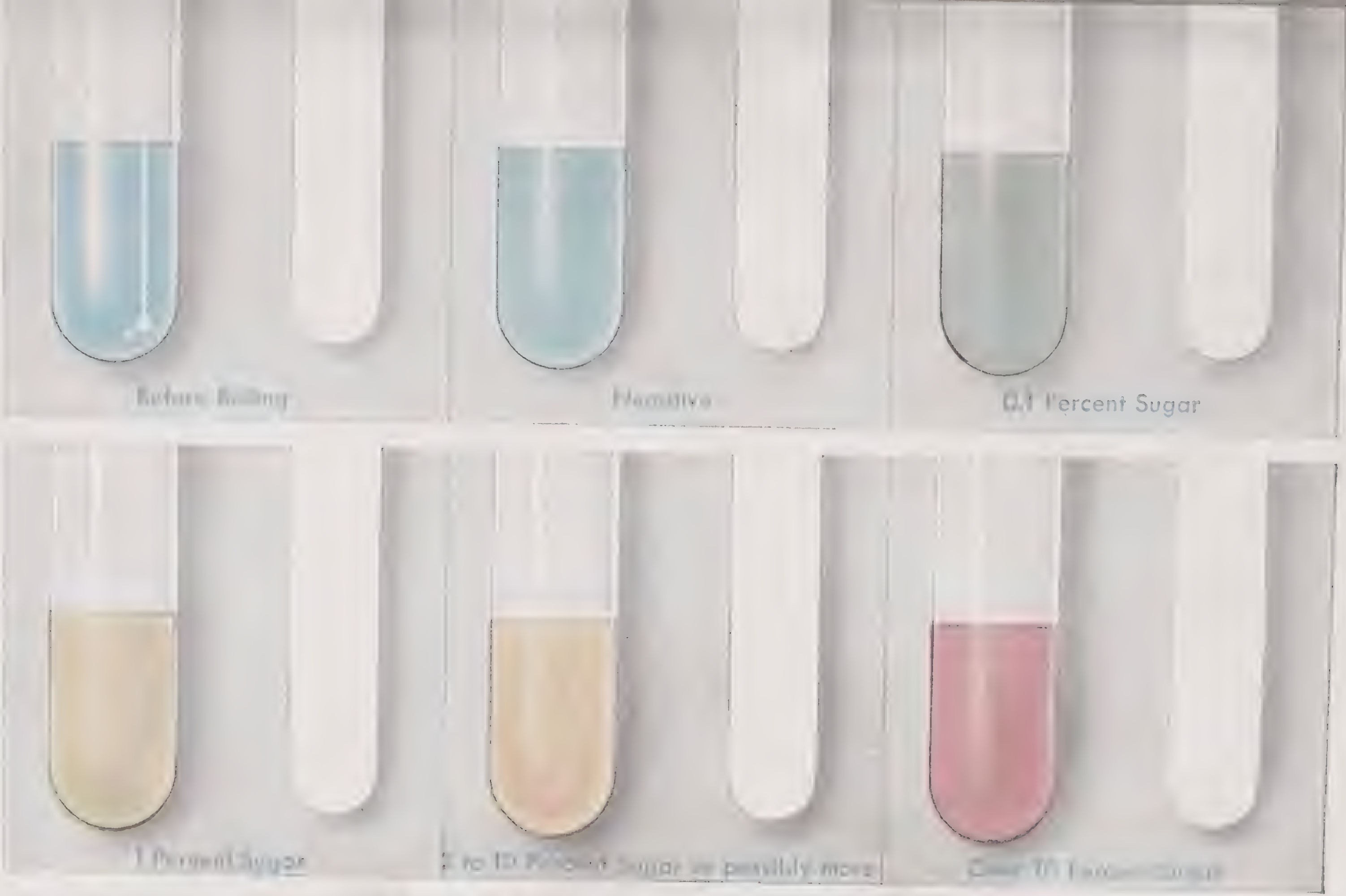
5. Before removing needle from bottle hold the syringe point upward and expel air or extra insulin, bringing the piston exactly to the proper mark.

C. Injecting the Insulin

Insulin is best injected where the skin is relatively loose: the outside of the upper arm and the front of the thigh. It is best to administer successive doses in different places.

1. Rub a small area of skin with alcohol or iodine.

2. Pinch and lift up a fold of skin and insert needle well under skin, holding the syringe parallel to the



Quantitative Estimation from the Benedict Qualitative Test for Sugar in Urine.
(Eli Lilly and Company)

surface where injection is being made.

3. Expel the insulin gradually while withdrawing the needle slowly to avoid leaving all the insulin in one spot.

4. Rub the spot with gauze which has been moistened with alcohol.

D. Care of Equipment

1. Keep the insulin in a cool place.

2. Wash syringe and needle in cold water immediately. Warm water and soap may occasionally be necessary. Rinse thoroughly.

3. Dry with a cloth and force some pure alcohol through the needle a few times to dry it. A fine wire should always be kept in the needle. The needle may be rubbed with petrolatum to prevent rusting.

Directions for the Injection of Special Insulin Preparations

PROTAMINE ZINC INSULIN

1. The vial containing the protamine zinc insulin should be kept in the refrigerator. If left in a warm room for only a short time, some of the precipitate will adhere to the glass.

2. The syringe should not only be sterile and dry, but should be cool at time of use. A 24- to 25-gauge needle is preferable.

3. Immediately before injection, the insulin vial should be shaken very gently in order to produce uniform distribution of the sediment without frothing.

GLOBIN INSULIN

This is given in the same way as regular or crystalline insulin. (See above.)

INSULIN MIXTURES

In the past few years the injection of mixtures of protamine zinc and regular insulin have become quite popular in treatment. At the present time no prepared mixtures are available for general use. It is necessary for the patient to prepare and inject the mixtures each morning in the following manner:

1. Withdraw the prescribed number of units of regular or crystalline insulin into the syringe.

2. Using the same needle and syringe, withdraw the prescribed number of units of protamine zinc insulin.

3. Inject the mixture under the skin in the usual manner.

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References

REFERENCE BOOKS AND SCIENTIFIC JOURNALS

PART ONE

NUTRITION

(*See also* Diet Therapy—General References, page 681)

GENERAL REFERENCES

Books:

Bogert, L. J.: Nutrition and Physical Fitness, Philadelphia, Saunders, 1943.
Chaney, M. S., and M. Ahlborn: Nutrition, Boston, Houghton, 1943.
Handbook of Nutrition: Chicago, A.M.A., 1943.
Hawley, E. E., and G. Carden: The Art and Science of Nutrition, St. Louis, Mosby, 1944.
Hawley, E. E., and E. E. Maurer-Mast: Fundamentals of Nutrition, Springfield, Ill., Thomas, 1940.
Macy, I. G., and H. H Williams: Hidden Hunger, Lancaster, Pa., Cattell, 1945.
McCollum, E. V., E. Orent-Keiles and H. G. Day: Newer Knowledge of Nutrition, ed. 5, New York, Macmillan, 1939.
Rose, M. S.: Foundations of Nutrition, ed. 4, edited by G. Macleod and C. M. Taylor, New York, Macmillan, 1944.
Rose, M. S.: Feeding the Family, ed. 4, New York, Macmillan, 1940.
Sherman, H. C.: Chemistry of Food and Nutrition, ed. 7, New York, Macmillan, 1946.
Sherman, H. C., and C. S. Lanford: Essentials of Nutrition, ed. 2, New York, Macmillan, 1943.
United States Department of Agriculture: Year Book for 1939—Food and Life, Washington, Govt. Printing Office.

Journals and Annuals:

American Journal of Public Health.
Annual Review of Biochemistry.
Borden's Review of Nutrition Research.
Food Research.
Journal of the American Dietetic Association.
Journal of Biological Chemistry.
Journal of Home Economics.
Journal of Nutrition.
Milbank Memorial Fund Quarterly.

Nutrition Abstracts and Reviews.
Nutrition Reviews.
Proceedings of the Society for Experimental Biology and Medicine.
Science.
Vitamins and Hormones.

FOR LAY READERS

Books:

Amidon, Bradbury and Drinckhahn: Good Food and Nutrition for Young People and Their Families, New York, Wiley, 1946.

Bogert, L. J.: Good Nutrition for Everybody, Chicago, Univ. Chicago Press, 1942.

Graubard, M.: Man's Food: Its Rhyme or Reason, New York, Macmillan, 1943.

Sense, E.: Nutrition with Sense, New York, Barrows, 1944.

Sherman, H. C.: Principles of Nutrition and Nutritive Value of Food, U. S. Department of Agriculture Misc. Pub. No. 546, 1944.

Sherman, H. C., and C. S. Lanford: An Introduction to Foods and Nutrition, New York, Macmillan, 1943.

Taylor, D.: The Nutrition Handbook, Garden City, New York, Doubleday, 1942.

Journals:

Consumer's Guide.
Hygeia.
Practical Home Economics.
Science Digest.
Science News Letter.

NATIONAL AND INTERNATIONAL FOOD PROBLEMS

Books and Pamphlets:

Bennett, M. K.: Food for Postwar Europe: How Much and What, War-Peace Pamphlet No. 5 Food Research Institute, Stanford University.

Brandt, K.: The Marriage of Nutrition and Agriculture in Food for the World, Chicago, University Chicago Press, 1945.

National Planning Association: A Food and Nutrition Program for the Nation, Planning Pamphlet No. 46, National Planning Association, 800 21st St., N.W., Washington, D. C., 1945.

——: Food for Europe After Victory, Planning Pamphlet No. 29, National Planning Association, 800 21st St., N.W., Washington, D. C., 1944.

Nutritive Value of Per Capita Food Supply 1909-1945, Bureau of Human Nutrition and Home Economics, July, 1946.

Pearson, F. A., and F. A. Harper: The World's Hunger, Ithaca, N. Y., Cornell Univ. Press, 1945.

World Food Survey, F.A.O., July, 1946.

Journal Articles:

Davis, J. S.: Standards and content of living, Am. Economic Review, March, 1945.

——: Nutrition, social science and public policy, Ann. Am. Acad. Polit. & Social Sc., January, 1943.

Editorial: Famine stalks the earth, Consumer's Guide, May, 1946.

——: A generation of American food, Consumer's Guide, September, 1946.

Mitchell, H. S., and N. F. Joffe: Food patterns of some European countries: background for study programs and guidance of relief workers, J. Am. Dietet. A. **20**:676, 1944.

National Food Situation, Monthly Publication, Bureau of Agricultural Economics, U. S. Department of Agriculture.

METABOLISM

ENERGY

Books:

DuBois, E. F.: Basal Metabolism in Health and Disease, ed. 3, Philadelphia, Lea, 1936.

Duncan, G. G.: Diseases of Metabolism, Philadelphia, Saunders, 1942.

Newburgh, L. H., W. W. Johnston and J. D. Newburgh: Some Fundamental Principles of Metabolism, Ann Arbor, Mich., Edwards, 1945.

Sherman, H. C.: Chemistry of Food and Nutrition, Chaps. 8, 9 & 10, New York, Macmillan, 1946.

Journal Articles:

Butt, H. R., and M. V. Leary: Diseases of metabolism, review of certain recent contributions, Arch. Int. Med. **67**:411, 1941.

DuBois, E. F.: The neglected field of heat loss, Nutrition Rev. **1**:385, 1943.

Maynard, L. A.: The Atwater system of calculating the calorie value of diets, J. Nutrition **28**:443, 1944.

Murlin, J. R.: Energy metabolism, Ann. Rev. Physiol. **1**:131-162, 1939.

Orr, J. B., and I. Leitch: The determination of the caloric requirements of man, Nutrition Abstr. & Rev. **7**:509-529, 1938.

Review: The present knowledge of calories in human nutrition, Nutrition Rev. **4**:34, 1946.

PROTEIN

Books:

Block, R. J., and D. Bolling: Amino Acid Composition of Proteins and Natural Foods, Springfield, Ill., Thomas, 1944.

Monograph: Proteins and Amino Acids: Physiology, Pathology, Therapeutics, Yonkers, N. Y., Arlington Chemical Co., 1944.

Sahyun, M., *et al.*: Outline of the Amino Acids and Proteins, New York, Reinhold, 1944.

Journal Articles:

Bricker, M., H. H. Mitchell and G. Kinsman: The protein requirements of adult human subjects, etc., J. Nutrition **30:**269, 1945.

Cuthbertson, D. P.: Quality and quantity of protein in relation to human health and disease, Nutrition Abstr. & Rev. **10:**1-20, 1940.

Darling, R. C., *et al.:* Effects of variations in dietary protein on physical well-being of men doing manual work, J. Nutrition **28:**273-281, 1944.

Elman, R.: Protein metabolism and the practice of medicine, M. Clin. North America **27:**303, 1943.

——: The practical use of amino acids in protein nutrition, J.A.M.A. **128:**659, 1945.

Gaunt, W. E.: Protein hydrolysates in intravenous alimentation, Nutrition Abstr. & Rev. **13:**501, 1944.

Lewis, H. B.: Proteins in nutrition, J.A.M.A. **120:**198, 1942. A.M.A. Handbook of Nutrition II.

Mitchell, H. H.: The contribution of amino acids to normal nutrition, J. Am. Dietet. A. **18:**137, 1942.

Review: Present knowledge of protein in human nutrition, Nutrition Rev. **4:**6, 1946.

——: Nitrogen absorption, nitrogen balance and the biological value of proteins, Nutrition Rev. **4:**29, 1946.

Rose, W. C., *et al.:* The role of amino acids in human nutrition, J. Biol. Chem. **146:**683, 1942.

——: Further experiments on the role of amino acids in human nutrition, J. Biol. Chem. **148:**457, 1943.

Sahyun, M.: Protein deficiency in man, Am. J. Digest. Dis. **13:**59, 1946.

Stare, F. J.: Protein: its role in human nutrition, J.A.M.A. **127:**985, 1945.

——: Protein nutrition in problems of medical interest, J.A.M.A. **127:**1052, 1945.

Turner, D. F.: Selection of protein containing foods to meet protein requirements, J.A.M.A. **128:**590, 1945.

Youmans, J. B.: The clinical detection of protein deficiency, J.A.M.A. **128:**439, 1945.

FAT AND LIPID

Journal Articles:

Barnes, R. H., and E. M. MacKay: Fat metabolism, Ann. Rev. Biochem. **13:**211-238, 1944.

Burr, G. O., and R. H. Barnes: Fat metabolism, Ann. Rev. Biochem. **12:**157-182, 1943.

Cook, R. P.: Cholesterol metabolism, Nutrition Abstr. & Rev. **12:**1-11, 1942.

Cowgill, G. R.: Relative nutritive values of animal and vegetable fats, Physiol. Rev. **25:**664, 1945.

Deuel, H. J., Jr., *et al.:* Studies on the comparative nutritive value of fats, J. Nutrition **31:**737, 1946.

McHenry, E. W., and M. L. Cornett: The role of vitamins in the anabolism of fats, Vitamins and Hormones **2:**1-24, 1943.

Review: Fatty acid metabolism, Nutrition Rev. **4:**23, 1946.

CARBOHYDRATE

Journal Articles:

Review: Present knowledge of carbohydrate in nutrition, Nutrition Rev. **4:**9 1946.

——: The American breakfast and mid-morning hypoglycemia, Nutrition Rev **2:**25, 1944.

INTERMEDIARY METABOLISM

Journal Article:

Review: Isotopes in nutrition research. The intermediary metabolism of fats proteins and carbohydrates. Borden's Rev. **6:**No. 8, 1945.

MINERAL

Book:

Shohl, A. T.: Mineral Metabolism, New York, Reinhold, 1939.

Journal Articles:

Review: Fluorine and dental health, Borden's Rev. No. 3, Dec. 3, 1942.

——: Trace elements in nutrition—iodine, Borden's Rev. No. 6, Sept., 194

——: Trace elements in nutrition—manganese, Borden's Rev. No. 1, Jan., 194

——: Trace elements in nutrition—iron, Borden's Rev. No. 4, April, 1944.

——: Isotopes in nutrition research, Mineral Metabolism, Borden's Rev. No. Nov., 1945.

——: Present knowledge of the minerals in nutrition, Parts 1 and 2, Nutritio Rev. **4:**195 and 227, 1946.

VITAMINS

Books:

American Medical Association: The Vitamins, a Symposium, Chicago, A.M.A. 1939.

Eddy, W. H., and G. Dalldorf: The Avitaminoses, ed. 3, Baltimore, William & Wilkins, 1944.

Evans, E. A., ed.: The Biological Action of the Vitamins, a Symposium, Chicago, Univ. Chicago Press, 1942.

Harris, R. S., and K. V. Thimann: Vitamins and Hormones (annual), New York, Acad. Press, started 1943.

Rosenberg, H. R.: Chemistry and Physiology of the Vitamins, New York, Interscience, 1945.

Williams, R. J.: What to Do About Vitamins, Norman, Okla., Univ. Oklahom Press, 1945.

Journal Articles:

Cowan, D. W., *et al.:* Vitamins for the prevention of colds, J.A.M.A. **120:**126 1942.

Kruse, H. D.: A concept of deficiency states, Milbank **20:**245, 1942.

Mitchell, H. H.: The chemical and physiological relationship between vitamins and amino acids, Vitamins and Hormones **1:**157-197, 1943.

Moore, T.: The interrelation of vitamins, Vitamins and Hormones 3:1-18, 1945.

Peterson, W. H.: The merging of growth factors and vitamins, Biol. Symposia **5**:31-43, 1941.

Review: Present knowledge of the vitamin B complex in human nutrition, Nutrition Rev. **4**:130-163, 1946.

Williams, R. J.: The significance of the vitamin content of tissues, Vitamins and Hormones, **1**:229-246, 1943.

VITAMIN A

Journal Articles:

Heilbron, I. M., *et al.*: The chemistry and physiology of vitamin A, Vitamins and Hormones **2**:155-213, 1944.

Kruse, H. D.: The ocular manifestations of avitaminosis A, Pub. Health Rep. **56**:1301, 1941.

Review: Storage of vitamin A in the body, Nutrition Rev. **1**:176, 1943.

——: Ophthalmology and vitamins, Nutrition Rev. **1**:183, 1943.

——: The metabolism of vitamin A, Nutrition Rev. **1**:300, 1943.

——: Effects of vitamin A depletion in man, Nutrition Rev. **1**:348, 1943.

——: Regulation and significance of plasma vitamin A level, Nutrition Rev. **2**:176, 1944.

——: Present knowledge of vitamin A in nutrition, Nutrition Rev. **4**:67, 1946.

VITAMIN D

Journal Articles:

Editorial: Milk constituents and the effectiveness of vitamin D, J.A.M.A. **107**:215, 1936.

Parke, E. A.: The therapy of rickets, J.A.M.A. **115**:370, 1940.

Review: Vitamin D and tooth decay, Nutrition Rev. **1**:5, 1942.

——: Massive doses of vitamin D in the treatment of rickets, Nutrition Rev. **1**:337, 1943.

VITAMIN E

Journal Articles:

Council on Pharmacy and Chemistry: The treatment of habitual abortion with vitamin E, J.A.M.A. **114**:2214, 1940.

Mason, K. E.: Physiological action of vitamin E and its homologues, Vitamins and Hormones **2**:107-148, 1944.

Review: Muscular dystrophy and vitamin E deficiency, Nutrition Rev. **1**:7, 1942.

——: Vitamin E and muscle physiology, Nutrition Rev. **1**:308, 1943.

——: Vitamin E in veterinary and clinical medicine, Borden's Rev. No. 7, Sept., 1945.

——: Codliver oil and the production of vitamin-E deficiency, Nutrition Rev **1**:381, 1943.

VITAMIN K

Journal Articles:

Review: Specificity of hemorrhagic preventive factors, Nutrition Rev. **1:**52, 1942.

——: The story of vitamin K, Borden's Rev. No. 4, April, 1943.

Snell, A. M.: Vitamin K: its properties, distribution and clinical importance, J.A.M.A. **112:**1457, 1939.

ASCORBIC ACID

Journal Articles and Books:

Hess, A. F.: Scurvy Past and Present, Philadelphia, Lippincott, 1920.

Review: Metabolism and function of ascorbic acid, Nutrition Rev. **2:**283, 1944.

——: Pathologic changes in vitamin C deficiency, Nutrition Rev. **1:**305, 1943.

——: Present knowledge of ascorbic acid in nutrition, Nutrition Rev. **4:**259, 1946.

Roberts, V. M.: A study of the ascorbic acid requirement of children of early school age, J. Nutrition **24:**25, 1942.

Roberts, V. M., *et al.:* The ascorbic acid requirement of school-age girls, J. Nutrition **26:**539, 1943.

THIAMINE

Journal Articles:

Cowgill, G. R.: Vitamin deficiencies and the nervous system: a consideration of the contribution of animal experimentation, Yale J. Biol. & Med. **12:**205, 1940.

Melnick, D.: A critique of values suggested as the thiamine requirements of man, J. Am. Dietet. A. **20:**516, 1944.

Review: Stability of thiamine to heat, Nutrition Rev. **2:**143, 1944.

——: Subclinical vitamin deficiency: thiamine, Nutrition Rev. **3:**93, 1945.

——: Thiamine requirement in man, Nutrition Rev. **2:**140, 1944.

RIBOFLAVIN

Journal Articles:

Cheldelin, V. H., and R. R. Williams: Studies of the average American diet. II. Riboflavin, nicotinic acid and pantothenic acid content. J. Nutrition **26:**417, 1943.

Kruse, H. D., *et al.:* Riboflavin deficiency in man, Pub. Health Rep. **55:**157, 1940.

Review: Human requirement of riboflavin, Nutrition Rev. **1:**335, 1943.

——: Riboflavin metabolism, Nutrition Rev. **1:**267, 1943.

——: Specificity of ariboflavinosis syndrome in man, Nutrition Rev. **1:**327, 1943.

——: The human requirement for riboflavin, Borden's Rev. No. 8, Oct., 1944.

——: The ocular criteria of riboflavin deficiency, Nutrition Rev. **2:**139, 1944.

Sydenstricker, V. P.: Clinical manifestations of ariboflavinosis, Am. J. Pub. Health **31:**344, 1941.

Warkany, J., and E. Schraffenberger: Congenital malformations induced in rats by material nutritional deficiency. VI. The preventive factor. J. Nutrition **27**:477, 1944.

Williams, R. D., *et al.*: Observations on induced riboflavin deficiency and the riboflavin requirement of man, J. Nutrition **25**:361, 1943.

NIACIN AND NIACINAMIDE

Journal Articles:

Editorial: The comparative value of niacin and nicotinamide, Nutrition Rev. **4**:65, 1946.

Elvehjem, C. A.: The relation of nicotinic acid to pellagra, Physiol. Rev. **20**:249-271, 1940.

——: Nicotinic acid in nutrition, Ann. Int. Med. **13**:225, 1939.

Review: Nicotinic acid—key vitamin in pellagra, Borden's Rev. No. 8, Nov., 1943.

PANTOTHENIC ACID

Journal Articles:

Jukes, T. H.: The distribution of pantothenic acid in certain products of natural origin, J. Nutrition **21**:193, 1941.

Reviews: Pantothenic acid: history, chemistry and nutritional significance, Borden's Rev. **5**:Nos. 2 and 3, 1944.

Review: Pantothenic acid metabolism, Nutrition Rev. **4**:69, 1946.

Spies, T. D., *et al.*: Pantothenic acid in human nutrition, J.A.M.A. **115**:523, 1940.

PYRIDOXINE

Journal Articles:

Review: Pyridoxine in dermatology, Nutrition Rev. **1**:370, 1943.

——: The function of pyridoxine in amino acid metabolism, Nutrition Rev. **3**:72, 1945.

Spies, T. D., *et al.*: Vitamin B_6 (pyridoxine) deficiency in human beings, J.A.M.A. **115**:839, 1940.

BIOTIN

Journal Articles:

Review: Biotin in human nutrition, Nutrition Rev. **1**:18, 1942.

——: Biotin metabolism in man, Nutrition Rev. **1**:199, 1943.

——: Biotin in nutrition, Borden's Rev. No. 3, March, 1943.

Williams, R. H.: Clinical biotin deficiency, New England J. Med. **228**:247, 1943; Nutrition Abstr. & Rev. **13**:279, 1943.

FOLIC ACID

Journal Articles:

Review: Anemia and granulocytopenia in relation to pantothenic acid and folic acid deficiencies, Nutrition Rev. **4**:91, 1946.

——: Folic acid, Nutrition Rev. **4**:199, 1946.

Review: Folic acid and related factors, Nutrition Rev. **3**:165, 1945.

——: Folic acid in raw and cooked meats, Nutrition Rev. **4**:286, 1946.

——: L. casei factor in the treatment of macrocytic anemias, Nutrition Re **4**:102, 1946.

——: Some clinical investigations with isolated and synthetic L. casei facto and related compounds, Nutrition Rev. **4**:11, 1946.

Spies, T. D.: Folic acid for macrocytic anemia in relapse, J.A.M.A. **130**:474 an 496, 1946.

Zueler, W. W.: Folic acid in anemia, J.A.M.A.**131**:7, 1946.

OTHER VITAMINS—CHOLINE, INOSITOL, PARA-AMINOBENZOIC ACID

Journal Articles:

Ansbacher, S.: Para-aminobenzoic: experimental and clinical studies, Vitamin and Hormones **2**:215-247, 1944.

Best, C. H., and C. C. Lucas: Choline—chemistry and significance as a dietar factor, Vitamins and Hormones **1**:1-51, 1943.

Review: Biochemical defect in choline deficiency, Nutrition Rev. **2**:275, 1944

——: Choline in animal and human nutrition, Nutrition Rev. **2**:314, 1944.

FOOD VALUES

Books and Pamphlets:

Adams, G., and S. L. Smith: The Vitamins Content and the Preservation o Foods, U. S. Department of Agriculture Misc. Pub. No. 536, 1944.

Bowes, A. DeP., and C. F. Church: Food Values of Portions Commonly Used Philadelphia, Philadelphia Child Health Assn., 311 Juniper Street, 1944

Bridges, M.: Dietetics for the Clinician, ed. 4, Philadelphia, Lea, 1941.

Chatfield, C. C., and C. Adams: Proximate Composition of American Foo Materials, U. S. Department of Agriculture Cir. No. 549, 1940.

Smith, S. L.: Promoting Better Nutrition, U. S. Department of Agricultur Report on Agricultural Experimental Stations, 1944.

Tables of Food Composition in Terms of Eleven Nutrients, Bureau of Huma Nutrition and Home Economics, U. S. Department of Agriculture Misc Pub. No. 572, 1945.

Tables of Vitamin Losses in Cooking Foods, National Research Council, Washington, D. C., 1943.

Taylor, C. M.: Food Values in Shares and Weights, New York, Macmillan 1942.

Journal Articles:

Donelson, E. G., and J. M. Leichsenring: Food composition table for shor method of dietary analysis, J. Am. Dietet. A. **21**:440, 1945.

Maynard, L. A.: The Atwater system of calculating the caloric value of diets J. Nutrition **28**:443, 1944.

CHEMISTRY OF FOOD AND COOKERY

Books:

Halliday, E. G., and I. T. Nobel: Food Chemistry and Cookery, Chicago, Univ. Chicago Press, 1943.

Hughes, O.: Introductory Foods, New York, Macmillan, 1940.

Justin, M. Rust, and G. Vail: Foods, Boston, Houghton, 1940.

Lanman, F. R., H. McKay and F. Zuill: The Family's Food, Philadelphia, Lippincott, 1937.

Lowe, B.: Experimental Cookery, New York, Wiley, 1943.

Wilmot, J. S., and M. Q. Batjer: Food for the Family, ed. 2, Philadelphia, Lippincott, 1944.

PEDIATRICS AND CHILD NUTRITION

Books:

Aldrich, C. A., and M. M. Aldrich: Feeding Our Old-fashioned Children, New York, Macmillan, 1945.

Gesell, A., and F. L. Ilg: Feeding Behavior of Infants, Philadelphia, Lippincott, 1937.

——: Infant and Child in the Culture of Today, New York, Harper, 1943.

——: The Child from Five to Ten, New York, Harper, 1946.

Holt, L. E.: Care and Feeding of Children, ed. 16, New York, Appleton-Century, 1943.

Jeans, P. C., and W. Rand: Essentials of Pediatrics, ed. 4, Philadelphia, Lippincott, 1946.

Lowenberg, E.: Your Child's Food, New York, McGraw-Hill, 1939.

Macy, I. G.: Nutrition and Chemical Growth in Childhood, Springfield, Ill., Thomaas, 1942 (vol. 1, Evaluation) and 1943 (vol. 2, Interpretation).

Monsch, H., and M. K. Harper: Feeding Babies and Their Families, New York, Wiley, 1943.

Pfaffman, Mary, and F. Stern: How to Teach Nutrition to Children, New York, Barrows, 1942.

Rand, W., M. E. Sweeney and E. L. Vincent: Growth and Development of the Young Child, ed. 3, Philadelphia, Saunders, 1940.

Roberts, L. J.: Nutrition Work with Children, Chicago, Univ. Chicago Press, 1943.

——: The Road to Good Nutrition, U. S. Department of Labor, Children's Bureau, Pub. No. 270, rev. 1944.

Senn and Newell: All About Feeding Children, Garden City, N. Y., Doubleday, 1944.

Sweeney, M. E., and M. E. Breckenridge. How to Feed Children in Nursery School, Detroit, Merrill-Palmer School, 1945.

Todhunter, E. N.: Everyday Nutrition for School Children, Tuscaloosa, Univ Alabama Extension, 1945.

Journals:

The American Journal of Diseases of Children.

The Journal of Pediatrics.

GERIATRICS

Books:

Cowdry, *et al.:* Problems of Ageing, Baltimore, Williams & Wilkins, 1942.
Gumpert, M.: You Are Younger Than You Think, New York, Duell, Sloan Pearce, Inc., 1944.
Lawton, G., ed.: New Goals for Old Age, New York, Columbia Univ. Pres 1945.
Stieglitz, E. J., ed.: Geriatric Medicine: Diagnosis and Management of Diseas in the Aging and in the Aged, Philadelphia, Saunders, 1943.

Journals and Journal Articles:

Geriatrics, vol. 1, 1946, official journal of the American Geriatric Society.
The Journal of Gerontology, vol. 1, 1946, official journal of the Gerontolog Society, Inc.
Duckles, D.: Nutrition in Geriatrics, J. Am. Dietet. A. **18:**508, 1942.
Review: Nutrition in geriatrics, Borden's Rev. **6:**No. 3, 1945.
Tuohy, E. L.: Feeding the Aged, J.A.M.A. **121:**42, 1943. (Also Handbook o Nutrition 19.)

BIOCHEMISTRY

Books:

Bodansky, M.: Introduction to Physiological Chemistry, ed. 4, New York Wiley, 1938.
Bodansky, M., and O. Bodansky: Biochemistry of Disease, New York, Macmillan, 1940.
Gortner, R. A.: Outlines of Biochemistry, ed. 2, New York, Wiley, 1938.
Harrow, B.: Textbook of Biochemistry, Philadelphia, Saunders, 1943.
Hawk, P. B., and O. Bergeim: Practical Physiological Chemistry, ed. 11, Philadelphia, Blakiston, 1937.
Mitchell, P. H.: Biochemistry, New York, McGraw-Hill, 1946.

Journals:

Annual Review of Biochemistry, Stanford University Press.
Biochemical Journal.
Journal of Biological Chemistry.
Proceedings of Experimental Biology and Medicine.

PHYSIOLOGY AND MEDICINE

Textbooks:

Alvarez, W. G.: Introduction to Gastro-enterology (Mechanics of the Digestiv Tract), ed. 3, New York, Hoeber, 1939.
Bailiff, R. N., and D. L. Kimmel: Structure and Function of the Human Bod Philadelphia, Lippincott, 1945.
Best, C. H., and N. B. Taylor: The Physiological Basis for Medical Practic Baltimore, Williams & Wilkins, 1945.
Cannon, W. B.: The Wisdom of the Body, New York, Norton, 1939.

Carlson, A. J., and W. E. Johnson: Machinery of the Body, ed. 2, Chicago, Univ. Chicago Press, 1941.

Cecil, R. L.: Textbook of Medicine, ed. 6, Philadelphia, Saunders, 1945.

Crandall, L. A.: An Introduction to Human Physiology, Philadelphia, Saunders, 1944.

Greisheimer, E. M.: Physiology and Anatomy, ed. 5, Philadelphia, Lippincott, 1945.

Howell, W. H.: Physiology, ed. 15, Philadelphia, Saunders, 1946.

Jung, F. T., and E. C. Earle: Anatomy and Physiology, Philadelphia, Davis, 1945.

Macleod, J. J. R.: Physiology of Modern Medicine (P. Bard, ed.), ed. 9, St. Louis, Mosby, 1941.

Stiles, P. G.: Human Physiology, ed. 8, Philadelphia, Saunders, 1940.

Wiggers, C. J.: Physiology of Health and Disease, ed. 4, Philadelphia, Lea, 1944.

Journals:

American Journal of Physiology.

Annual Review of Physiology.

Physiological Reviews.

PART TWO

DIET THERAPY

GENERAL REFERENCES

Books:

Barborka, C. J.: Treatment by Diet, Philadelphia, Lippincott, 1947.

Cecil, R. L.: A Textbook in Medicine, Philadelphia, Saunders, 1947.

Duncan, G. G.: Diseases of Metabolism, Philadelphia, Saunders, 1942.

Handbook of Nutrition (a symposium): Chicago, A.M.A., 1943.

Hawley, E. E., and G. Carden: The Art and Science of Nutrition, St. Louis, Mosby, 1944.

McLester, J. S.: Nutrition and Diet in Health and Disease, Philadelphia, Saunders, 1943.

Mitchell, K.: Food in Health and Disease, Philadelphia, Davis, 1942.

Pattee, A. F.: Dietetics (revised by H. Munsell), New York, Putnam, 1945.

Pelner, L.: The Diet Therapy of Disease (handbook), New York, Personal Diet Service, 1944.

Proudfit, F. T., and C. H. Robinson: Nutrition and Diet Therapy, New York, Macmillan, 1946.

Stern, F.: Applied Dietetics, Baltimore, Williams & Wilkins, 1943.

Wohl, M. G.: Dietotherapy, Philadelphia, Saunders, 1945.

Journals:

The American Journal of Digestive Diseases.

American Journal of Nursing.

American Journal of Public Health and the Nation's Health.
Archives of Internal Medicine.
Journal of Clinical Investigation.
Journal of the American Dietetic Association.
Journal of the American Medical Association.
The Trained Nurse and Hospital Review.

Diet Manuals:

California Dietetic Association: Compilation of Diets, Los Angeles, Institute Press, 1942.
Johns Hopkins Hospital, Baltimore, Manual of Applied Nutrition, 1946.
Presbyterian Hospital, New York City, 1943.
Turner, D. F.: Diet Therapy Handbook, Univ. Chicago Press, 1946.
University of Kansas Hospitals, Lawrence, Univ. Kansas Press, 1945.
The University of Michigan Hospital, Ann Arbor, 1946.
Wesley Memorial Hospital, Chicago, 1946.

THERAPEUTIC DIETS AND THEIR MODIFICATIONS

Books:

See list of references in Diet Therapy—General.

Journal Articles:

Bowes, A. deP.: How to feed a patient, Mod. Hosp. **60**:72, 1943.
Dubois, E. F.: Fewer and better diets, J. Am. Dietet. A. **17**:199, 1941.
Goodman, J. I., and R. O. Garvin: Results of high caloric feeding, Gastroenterology **6**:537, 1946.
Grindley, J. H., and F. C. Mann: Effect of liquid and solid meals on intestinal activity, Am J. Digest. Dis. **8**:324, 1941.
Krause, M. V.: Some modern concepts concerning hospital diets, J. Am. Dietet. A. **20**:610, 1944.

DEFICIENCY DISEASES

Book:

Youmans, J. B.: Nutritional Deficiencies: Diagnosis and Treatment, Philadelphia, Lippincott, 1941.

Journal Articles and Bulletins:

Committee on Diagnosis and Pathology of Nutritional Deficiencies: Inadequate Diets and Nutritional Deficiencies in the United States: Their Prevalence and Significance, Bull. No. 109, National Research Council, Washington, D. C., 1943.
Committee Report: Medical survey of nutrition in Newfoundland, reprinted from Canad. M. A. J. **52**:227, 1945 (colored plates).
Cox, G. J.: A critique of the etiology of dental caries, Vitamins and Hormones. **2**:255-299, 1944.
Field, H. J.: Laboratory methods of diagnosis of nutritional deficiency diseases, M. Clin. North America **27**:501, 1943.

Jolliffe, N., and R. M. Most: The appraisal of nutritional states, Vitamins and Hormones, **1**:60-104, 1943.

Kruse, H. D.: A concept of deficiency states, Milbank Mem. Fund Quart. **20**:245, 1942.

Moore, R. A.: The pathology of deficiency states, M. Clin. North America **27**:509, 1943.

Review: Conquest of pellagra, Borden's Rev. No. 7, Oct., 1943.

——: Diagnosing nutritional deficiencies, Borden's Rev. No. 2, Feb., 1945.

——: The prevalence of malnutrition, Borden's Rev. No. 5, May, 1944.

Ruffine, J. M.: Early deficiency diseases: their recognition and treatment, M. Clin. North America **27**:495, 1943.

Vitamin deficiencies: stigmas, symptoms and therapy, J.A.M.A. **131**:666-667, 1946.

OVERWEIGHT AND UNDERWEIGHT

Books:

See list of references in Diet Therapy—General.

Duncan, G. G.: Diseases of Metabolism, Chaps. 9 & 10, Philadelphia, Saunders, 1942.

Hauck, Hazel: How to Control Your Weight, Ithaca, N. Y., Cornell Univ. Bulletin, 1946.

Kain, I. J.: Prescription for Slimming, Philadelphia, David McKay Co., 1940.

Rony, H. R.: Obesity and Leanness, Philadelphia, Lea, 1940.

Journal Articles:

Brown, E. G., C. Herman and M. A. Ohlson: Weight reduction of obese women of college age, J. Am. Dietet. A. **22**:858, 1946.

Gill, D. J.: The role of personality and environmental factors in obesity, J. Am. Dietet. A. **22**:398, 1946.

Goldzieher, Max A.: Endocrine aspects of obesity, Am. J. Digest. Dis. **13**:40, 1946.

Levy, R. L., *et al.*: Overweight, J.A.M.A. **131**:951, 1946.

Newburgh, L. G.: Obesity and energy metabolism, Physiol. Rev. **24**:18 1944.

FEVERS AND INFECTIONS

Books:

See list of references on Diet Therapy—General.

Journal Articles:

Coburn, A. F., and L. V. Moore: Nutrition as a conditioning factor in the rheumatic state, Am. J. Dis. Child. **65**:744, 1943.

Coleman, Warren: Influence of high caloric diet in typhoid fever, J.A.M.A. **69**:329, 1917.

Dubois, E. F.: Mechanism of heat loss, Ann. Int. Med. **12**:388, 1938.

Farber, J. E., and D. K. Miller: Nutritional studies on tuberculosis, American Rev. Tuberc. **48**:406, 412, 1943; **50**:229, 1944.

DIABETES MELLITUS

Books:

See list of references in Diet Therapy—General.

John, H. J.: Diabetes, St. Louis, Mosby, 1946.

Joslin, E. P.: A Diabetic Manual for the Mutual Use of Doctors and Patients Philadelphia, Lea, 1941.

Joslin, E. P., *et al.:* The Treatment of Diabetes Mellitus, Philadelphia, Lea, 1940

Pollock, L. P.: Modern Diabetic Care, New York, Harcourt, 1940.

Rogers, F. L., and R. M. Leverton: Your Diabetes and How to Live with It Lincoln, Neb., the authors, 1945.

Rosenthal, Joseph, Frances Stern and Helen Rosenthal: Diabetic Care in Pictures, Philadelphia, Lippincott, 1946.

Wilder, R. M.: A Primer for Diabetic Patients, Philadelphia, Saunders, 1946

Journal Articles:

Almy, T. P., K. Swift and E. Tolstoi: Treatment of diabetic acidosis and coma J.A.M.A. **129:**863, 1945.

Diabetes Number: Am. J. Digest. Dis. **13:**127-171, 1946.

Guest, G. M.: Unrestricted diet in the treatment of juvenile diabetes, J. Am. Dietet. A. **23:**299, 1947.

John, H. J.: Treatment of diabetes mellitus without regard to hyperglycemia and glycosuria, Am. J. Digest. Dis. **10:**129, 1943.

Jost, F.: The dietary management of diabetes mellitus, J. Am. Dietet. A. **22:**392, 1946.

Mirsky, I. A.: Etiology of diabetic acidoses, J.A.M.A. **118:**690, 1942.

Newburgh, L. H.: Control of hyperglycemia of obese "diabetics" by weight reduction, Ann. Int. Med. **17:**935, 1942.

Stadie, W. C.: Fat metabolism in diabetes mellitus, Ann. Int. Med. **75:**325 1945.

DISEASES OF THE DIGESTIVE TRACT

GASTRIC DISORDERS

Books:

See list of references in Diet Therapy—General.

Kantor, J. L.: Synopsis of Digestive Diseases, St. Louis, Mosby, 1937.

Wohl, M. G.: Dietotherapy, Chap. 28, Philadelphia, Saunders, 1942.

Journal Articles:

Eads, J. T.: Massive gastro-intestinal hemorrhage, J.A.M.A. **131:**891, 1946.

Hayward, M. L.: Psychotherapy in the Treatment of Gastro-intestinal Disorders, Am. J. Digest. Dis. **13:**255, 1946.

Reed, John A.: Cancer of the stomach, Am. J. Digest. Dis. **13:**379, 1946.

PEPTIC ULCERS

Books:

See list of references in Diet Therapy—General.

Held, I. W., and A. Allen Goldbloom: Peptic Ulcer, Springfield, Ill., Thomas, 1946.

Kantor, J. L.: Synopsis of Digestive Diseases, St. Louis, Mosby, 1937.

Journal Articles:

Co Tui, *et al.*: The hyperalimentation treatment of peptic ulcer with amino acids and dextrimaltose, Gastroenterology **5**:5, 1945.

Riggs, H. E., *et al.*: The diet and chronic peptic ulcer, J.A.M.A. **124**:639, 1934.

Shay, H., *et al.*: Physiologic basis for the diet therapy in duodenal ulcer, J.A.M.A. **120**:740, 1942.

Steele, E.: Peptic Ulcer, Am. J. Digest. Dis. **11**:119, 1944.

Steigman, F., and A. R. Marks: Inhibition of peptic activity in the treatment of peptic ulcer, Am. J. Digest. Dis. **11**:173, 1941.

DISEASES OF THE INTESTINES

Books:

See list of references in Diet Therapy—General.

Journal Articles:

Drueck, C. J.: Treatment of ulcerative colitis, Am. J. Digest. Dis. **11**:10, 1944.

Fradkin, W. Z.: The diarrhea problem and general treatment, Am. J. Digest. Dis. **12**:261, 1945.

Garry, R. C.: The movement of the large intestine, Physiol. Rev. **14**:103, 1934.

Glaser, J., and Bruce: Treatment of epidemic diarrhea in infants, J. Pediat. **24**:53, 1944.

Karshbaum, Alfred: Raw apple therapy of diarrhea, Arch. Pediat. **57**:43, 1940.

Paulson, Moses: The common diarrhea and dysenteries of the adult, M. Clin. North America **23**:513, 1939.

Soper, H. W.: Chronic constipation, Am. J. Digest. Dis. **11**:255, 1944.

Williams, R. D., and W. H. Olmstead: The manner in which food controls the bulk of the feces, Ann. Int. Med. **10**:717, 1936.

——: The effect of cellulose, hemicellulose, and lignin on the weight of the stool, J. Nutrition **11**:433, 1936.

DISEASES OF THE LIVER AND BILIARY TRACT

Books:

See list of references in Diet Therapy—General.

Journal Articles:

Anderson, G. K.: The importance of protein in diet therapy, J. Am. Dietet. A. **21**: 1945.

Barker, Col. M. H., Major R. B. Coops and Major F. W. Allen: Chronic hepatitis, J.A.M.A. **129**:653, 1945.

Berger, F. M.: Diet in infectious hepatitis, J. Am. Dietet. A. **22**:210, 1946.

Cirrhosis of the liver and nutrition, Nutrition Rev. **1**:88, 1943.

Duckles, D.: Purine and cholesterol content of foods, J. Am. Dietet. A. **15**:772, 1939.

Gauss, Harry: Some biological considerations of gallstones, Am. J. Digest. Di **12:**187, 1945.

Grane, C. H.: Physiologic consideration in treatment of portal cirrhosi J.A.M.A. **121:**715, 1943.

Hoagland, C. H.: The therapy of liver diseases, Bull. N. Y. Acad. Me 21:537, 1945.

Joliffe, N., and E. Alpert: Treatment of cirrhosis of the liver by nutrition means, M. Clin. North America **29:**655, 1945.

Marin, F. C.: The role of the liver as the commissariat of the body, Am. Digest. Dis. **4:**355, 1937.

Okey, Ruth: Cholesterol content of foods, J. Am. Dietet. A. **21:**341, 1945.

Post, J., and A. J. Patek, Jr.: Serum proteins in cirrhosis of the liver: relation t prognosis and to formation of ascites, Arch. Int. Med. **69:**67, 1942.

Ralli, E. P., J. S. Robson, D. Clark and C. L. Hoagland: Factors invitin ascites in patients with cirrhosis of the liver, J. Clin. Investigation **25:**31 1945.

Rividin, I. S., *et al.:* The prevention of liver damage and the facilitation o repair in the liver by diet, J.A.M.A. **121:**322, 1943.

Stewart, J. D.: Nutrition in care of surgical patients with jaundice, J. Am Dietet. A. **17:**535, 1941.

Tyres, J. M., and J. R. Barnard: Diseases of the biliary tract associated wit disturbances in cholesterol metabolism, J.A.M.A. **111:**990, 1938.

ALLERGY AND SKIN DISEASES

Books:

See list of references in Diet Therapy—General.

Criep, L. H.: Essentials of Allergy, Philadelphia, Lippincott, 1945.

Feinberg, S. M.: Allergy in Practice, Chicago, Yr. Bk. Pub., 1945.

Rowe, A. H.: Elimination Diets and the Patients' Allergies, Philadelphia, Lea 1944.

Urbach, G., and P. H. Gottlieb: Allergy, New York, Grune & Stratton, 194

Vaughn, W. T.: A Primer of Allergy, St. Louis, Mosby, 1943.

Journal Articles:

Pelner, Louis: Gastrointestinal allergy, Am. J. Digest. Dis. **12:**17, 1945.

Turnbull, John A.: Some dermatologic aspects of allergy, Am. J. Digest. Dis **13:**9, 1946.

Waldbott, G. I.: Emergencies in the allergist's practice, J.A.M.A. **128:**1205, 194

CARDIOVASCULAR DISEASES

Books:

See list of references in Diet Therapy—General.

Levine, S. A.: Clinical Heart Disease, Philadelphia, Saunders, 1945.

Page, I. H., and A. C. Corcoran: Arterial Hypertension, Chicago, Yr. Bk. Pub. 1945.

White, P. D.: Heart Disease, New York, Macmillan, 1944.

Journal Articles:

Grollman, A., *et al.*: Sodium restriction in diet, J.A.M.A. **129**:533, 1945.
Irvine, J. H.: Heart disease and what to do about it, Hygeia **24**:32, 1946.
Leevy, C. M., *et al.*: Fluids in congestive heart failure, J.A.M.A. **131**:1120, 1946.
White, P. D.: Heart disease a world problem, p. 437, Bull. N. Y. Acad. Med., 1940.

DISEASES OF THE URINARY TRACT

Books:

See list of references in Diet Therapy—General.

Todd, J. C., and A. H. Sanford: Clinical Diagnosis by Laboratory Methods, Philadelphia, Saunders, 1944.

Journal Articles:

Addis, T.: Theory and practice in the dietetic treatment of glomerular nephritis, J. Am. Dietet. A. **16**:306, 1940.
Byfield, G. V.: Renal blood flow and glomerular filtration, J.A.M.A. **121**:118, 1943.
McIntosh, J. F.: The classification and chemical pathogenesis of urinary calculi, J. Clin. Investigation **21**:755, 1942.
Pitts, R. F.: The renal regulation of acid-base balance with special reference to the mechanism for acidifying the urine, Science **102**:49; **102**:81, 1945.
Simonds, J. P.: Renal pathological changes in hypertension and glomerulonephritis, J.A.M.A. **120**:89, 1942.
Warner, E. D.: Principles underlying causation and treatment of nephritis, M. Press **212**:86, 1944.

DISEASES OF THE BLOOD

Books:

See list of references in Diet Therapy.

Best, C. H., and N. B. Taylor: Physiological Basis of Medical Practice, Baltimore, Williams & Wilkins, 1946.
Kracke, R. R.: Color Atlas of Hematology, Philadelphia, Lippincott, 1947.
Wintrobe, M. M.: Clinical Hematology, Philadelphia, Lea, 1946.

Journal Articles:

Barer, A. P., and W. M. Fowler: Iron requirements for adults, J. Am. Dietet. A. **16**:769, 1940.
Fowler, W. M., and A. P. Barer: The treatment of iron deficiency anemias, J.A.M.A. **112**:110, 1939.
McKibbin, J., and F. Stare: Nutrition in blood regeneration, J. Am. Dietet. A. **19**:331, 1943.
Minot, G. R., and W. P. Murphy: Treatment of pernicious anemia by a special diet, J.A.M.A. **87**:470, 1926.
Murphy, W. P., *et al.*: Changes in composition of blood in pernicious anemia treated by diet rich in liver, J.A.M.A. **88**:1211, 1927.

Teeter, E. J.: Anemia therapy, J.A.M.A. **127**:973, 1945.

Whipple, G. H.: Hemoglobin and plasma proteins, Am. J. M. Sc. **203**:47 1942.

DISEASES OF MUSCULOSKELETAL AND NERVOUS SYSTEMS

Books:

See list of references in Diet Therapy.

Journal Articles:

Tallman, F. F.: Food and the mentally ill, J. Am. Dietet. A. **23**:6, 1947.

Turnbull, J. A.: Study of 127 cases of arthritis, Am. J. Digest. Dis. **11**:122, 194

——: Changes in sensitivity to allergenic foods in arthritis, Am. J. Digest. Di **11**:182, 1944.

Miller, M. M.: Low sodium chloride intake in treatment of insomnia an tension states, J.A.M.A. **129**:262, 1945.

Wood, Ruth: Nutrition in nervous and mental disorders, Borden's Review o Nutrition Research **7**:1, 1946, and **8**:1, 1947.

MISCELLANEOUS METABOLIC DISORDERS

Books:

See list of references in Diet Therapy.

Severinghaus, E. L.: Endocrine Therapy in General Practice, Chicago, Yr. Bk Pub., 1945.

Journal Articles:

Bartels, E. C.: Successful treatment of gout, Ann. Int. Med. **18**:21, 1943.

Conn, J. W.: The dietary management of spontaneous hypoglycemia, J. Am Dietet. A. **23**:108, 1947.

Fishberg, E. H., and J. Varzimer: Thiouracil therapy, J.A.M.A.**128**:915, 194

Hasser, E. O.: The diet in Addison's disease, J. Am. Dietet. A. **17**:955, 1941.

McCracken, J. P., *et al.:* Gout, J.A.M.A. **131**:367, 1946.

Thompson, W. O.: Thyroid dysfunctions and their treatment, J.A.M.A **117**:441, 1941.

PREOPERATIVE AND POSTOPERATIVE DIETS

Books:

See list of references in Diet Therapy.

Cole, W. H., and R. Elman: Textbook of General Surgery, New York, Appleton-Century, 1941.

Journal Articles:

Green, R.: Biochemical aspects of preoperative and postoperative treatment Am. J. Surg. **56**:288, 1942.

Hartzell, J. B., and R. Crowley: Vitamin therapy in the surgery patient, Am. J. Surg. **56**:288, 1942.

Howard, J. E.: Protein metabolism during convalescence after trauma, Arch. Surg. **50**:166, 1945.

Lawrence, K. B., and G. S. Comnick: Diets in general surgery, Am. J. Surg. **58**:181, 1942.

Wilensky, A. D.: Hyprotemenia, Arch. Surg. **48**:36, 1944.

Zintel, H.: The role of nutrition in preoperative and postoperative care, Am. J. M. Sc. **207**:253, 1944.

DISEASES OF INFANCY AND CHILDHOOD

Books:

See list of references in Diet Therapy.

Jeans, P. C., *et al.*: Essentials of Pediatrics, Philadelphia, Lippincott, 1946.

Pfaffman, M., and F. Stern: How to Teach Nutrition to Children, Boston, Barrows, 1942.

Journal Articles:

Bruch, Hilde: Dietary treatment of obesity in childhood, J. Am. Dietet. A. **20**:361, 1944.

Levine, S. Z.: Protein nutrition in pediatrics, J.A.M.A. **128**:283, 1945.

Rappaport, B. Z.: The treatment of infantile eczema, J.A.M.A. **112**:317, 1939.

Scola, E. A.: Banana and banana powder therapy in diarrheal diseases of infants and young children, New Orleans M. & S. J. **91**:192, 1938.

Senn, M. J. E.: Influence of psychological factors on the nutrition of children, Am. J. Pub. Health, **35**:211, 1945.

Stearns, G.: Diet in malnutrition and celiac disease, J. Pediat. **19**:12, 1941.

Glossary

The pronunciation follows the system of Webster's New International Dictionary, Second Edition.

acetone bodies (ăs′ê-tōn). Acetone, acetoacetic acid and beta-oxybutyric acid. Called also ketone bodies. (*See* ketosis, defined below.)

achlorhydria (ā′klōr-hī′drĭ-*ȧ*). Absence or diminished amount of hydrochloric acid in the gastric secretions.

achromotrichia (â-krō′mô-trĭk′ĭ-*ȧ*). Absence of pigment in the hair.

achylia gastrica (â-kīl′ĭ*ȧ* găs′trĭ-k*ȧ*). A condition in which the secretion of gastric juice is diminished or absent.

acidosis (ăs′ĭ-dō′sĭs). A condition in which the body's alkaline reserve is lowered due to abnormal loss of alkaline salts or abnormal accumulation of acids.

acne (ăk′nê). A chronic inflammatory disease of the sebaceous glands, occurring most frequently on the face, the back and the chest.

acrodynia (ăk′rô-dĭn′ĭ-*ȧ*). An eruptive skin disease. In humans, it is marked by pain in the soles of the feet and the palms of the hands.

adipose (ăd′ĭ-pōs). Fatty.

aerophagy (ā′ĕr-ŏf′*ȧ*-jĭ). Swallowing of air.

agranulocytosis (â-grăn′û-lô-sī-tō′sĭs). A condition in which there is a complete or nearly complete absence of the granular leukocytes (granulocytes) from the blood and the bone marrow.

albuminuria (ăl-bū-mĭ-nū′rĭ-*ȧ*). The presence of albumin in the urine.

alkaline reserve (ăl′k*ȧ*-līn). The amount of alkaline or basic material available in the body to neutralize acids.

alkalosis (ăl′k*ȧ*-lō′sĭs). A condition in which there is an excess of alkaline substances in the body.

allergen (ăl′ĕr-jĕn). Any substance capable of inducing allergy.

alopecia (ăl′ô-pē′shĭ-*ȧ*). Baldness, deficiency of hair.

anaphylaxis (ăn′*ȧ*-fĭ-lăk′sĭs). Unusual or exaggerated reaction or shock of the organism to foreign substances.

anorexia (ăn′ô-rĕk′sĭ-*ȧ*). Lack or loss of appetite for food.

antihemorrhagic (ăn′tĭ-hĕm′ŏ-răj′ĭk). Stopping hemorrhage. Often applied to vitamin K.

antineuritic (ăn′tĭ-nû-rĭt′ĭk). Counteracting neuritis. Often applied to thiamine.

antirachitic (ăn′tĭ-r*ă*-kĭt′ĭk). Preventive, curative or corrective of rickets. Often applied to vitamin D.

antiscorbutic (ăn′tĭ-skôr-bū′tĭk). Correcting or curing scurvy. Often applied to ascorbic acid.

anuria (*ă*-nū′rĭ-*ȧ*). Absolute suppression of urinary secretion.

arteriosclerosis (är-tē′rĭ-ô-sklê-rō′sĭs). A thickening and a hardening of the walls of arteries and capillaries.

ascites (*ă*-sī′tēz). Accumulation of fluid in the abdominal cavity.

ascorbic acid (â-skôr′bĭk). Vitamin C, deficiency of which is a causative factor in scurvy.

assay (*ă*-sā′). Examination or analysis of a substance.

atonic (*ȧ*-tŏn′ĭk). Lack of normal tone or vigor of an organ or part.

atrophy (ăt′rô-fĭ). A wasting away of a cell, tissue, organ or part.

avidin (ăv′id-ĭn). A protein-like substance isolated from egg white.

avitaminois (â-vī′t*ȧ*-mĭn-ō′sĭs). A condition due to the lack or the deficiency of a vitamin in the diet; or to lack of absorption or utilization of it.

bactericidal (băk-tēr′ĭ-sīd′*ă*l). Destructive to bacteria.

base (bās). A substance which combines with acids to form neutral compounds

benign (bê-nīn′). Mild, favorable for recovery.

bio-assay (bī′ō-ă-sā′). Examination or analysis of a substance by noting its effect on animals.

biotin (bī′ō-tĭn). A member of the vitamin B complex.

bradycardia (brăd′ĭ-kär′dĭ-ȧ). Abnormal slowness of the heartbeat.

calciferol (kăl-sĭf′ĕr-ōl). Vitamin D_2, produced by irradiating ergosterol.

calcification (kăl′sĭ-fĭ-kā′shŭn). Process by which organic tissue becomes hardened by a deposit of calcium salts.

calculus, pl. **calculi** (kăl′kū-lŭs). Commonly called stone.

calorimeter (kăl′ō-rĭm′ē-tĕr). An instrument for measuring the heat change in any system (such as the types pictured in Chapter 3, one of which is used to measure the amount of heat produced by the body), and the bomb calorimeter used to measure the calorie (energy) value of foods.

carotene (kăr′ō-tēn). A yellow pigment which exists in several forms; alpha, beta and gamma carotene are provitamins which may be converted into vitamin A in the body.

cheilosis (kī-lō′sĭs). A condition marked by lesions on the lips and cracks at the angles of the mouth.

chlorosis (klō-rō′sĭs). A peculiar anemia mostly affecting girls at the age of puberty. Often called green sickness because of the greenish pallor of the skin.

cholecystitis (kŏl′ē-sĭs-tī′tĭs). Inflammation of the gallbladder.

cholelithiasis (kŏl′ē-lĭ-thī′ȧ-sĭs). The presence or formation of gallstones.

cholesteremia (kō-lĕs-tē-rē′mĭȧ). Excess of cholesterol in the blood.

cholesterol (kō-lĕs′tĕr-ōl). The most common member of the sterol group, defined below.

chyme (kīm). The thick, grayish, semiliquid mass into which food is converted by gastric digestion. In this form it passes into the small intestines.

cirrhosis (sĭ-rō′sĭs). Inflammation with hardening of the tissues of an organ, more especially the liver.

colitis (kō-lī′tĭs). Inflammation of the colon.

colagen (kŏl′ȧ-jĕn). The main organic constituent of connective tissue and of the organic substance of bones: changeable by boiling into gelatin.

colloidal (kŏ-loi′dăl). Pertaining to a colloid, which is a substance containing tiny, solid, evenly dispersed particles not dissolved in the medium. Glue is an example.

congenital (kŏn-jĕn′ĭ-tăl). Existing at or dating from birth; hereditary.

cortex (kôr′tĕks). The outer layers of an organ as distinguished from its inner substance.

creatine (krē′ȧ-tēn). A nitrogenous end product of muscle metabolism. Found especially in muscle juice and blood.

cystitis (sĭs-tī′tĭs). Inflammation of the urinary bladder.

deaminization (dē-ăm′ĭn-ĭ-zā′shŭn). The process of metabolism by which the nitrogen portion (amino group) is removed from protein substances.

dehydration (dē′hīdrā′shŭn). Removal of water from the body or a tissue.

dermatitis (dûr′mȧ-tī′tĭs). Inflammation of the skin.

detoxication (dē-tŏk′sĭ-kā′shŭn). Removal of the toxic quality of a substance or the toxic substance from the body.

diuresis (dī′ū-rē′sĭs). Increased secretion of urine.

diverticulosis (dī′vĕr-tĭk-ū-lō′sĭs). The presence of small pouches or pockets leading off a main cavity or tube. Often occurs in the intestines.

dysentery (dĭs′ĕn-tĕr-ĭ). Inflammation of intestinal mucous membrane, especially the colon. The causative agent may be bacteria or parasitic worms.

dyspepsia (dĭs-pĕp′shȧ). Imperfect digestion. Not a disease in itself, but a symptom of some other disorder.

dyspnea (dĭsp-nē′ȧ). Difficult or labored breathing.

dystrophy (dĭs′trō-fĭ). Progressive weakening of a muscle.

eclampsia (ĕk-lămp′sĭ-ȧ). A sudden attack of convulsions. A major toxemia of pregnancy.

eczema (ĕk′zê-mȧ). A skin disease.

edema (ê-dē′mȧ). An accumulation of large amounts of fluid in the intertissue spaces of the body.

emaciation (ê-mā′sĭ-ā′shŭn). A wasted condition of the body.

emulsion (ê-mŭl′shŭn). A finely divided mixture or suspension of two liquids not mutually soluble.

endemic (ĕn-dĕm′ĭk). Pertaining to or prevalent in a particular district or region.

endocarditis (ĕn′dô-kär-dī′tĭs). Inflammation of the endocardium (inner lining membrane of the heart).

endocrine (ĕn′dô-krīn). Applied to organs whose function it is to secrete internally a substance which plays an important role in metabolism.

endogenous (ĕn-dŏj′ê-nŭs). Originating within the organism.

enzyme (ĕn′zīm). A substance, frequently protein in nature, formed in living cells which by contact brings about chemical changes but does not itself become a part of the reaction.

epithelium (ĕp′ĭ-thē′lĭ-ŭm). The covering of the skin and the mucous membranes, consisting of cells of various forms and arrangement.

ergosterol (ēr-gŏs′tēr-ōl). A sterol found in plant and in animal tissues which on exposure to ultraviolet light is converted into vitamin D_2. (*See* sterol.)

erythrocyte (ê-rĭth′rô-sīt). Red blood corpuscle.

etiology (ē′tĭ-ŏl′ô-jĭ). The study of the causation of a disease.

exogenous (ĕks-ŏj′ê-nŭs). Originating outside the organism.

extractive (ĕx-trăk′tĭv). Any substance present in a tissue or in a mixture in a small quantity, and requiring to be extracted by a special method.

extrinsic (ĕks-trĭn′sĭk). Coming from, or originating from, outside.

febrile (fē′brĭl). Pertaining to, or accompanied by, fever.

ferment (fûr′mĕnt). An enzyme, defined above.

flatulence (flăt′û-lĕns). Distention of the intestinal tract with gas or air.

gavage (gȧ′vȧzh′). Feeding by the stomach tube.

geriatrics (jĕr′ĭ-ăt′rĭks). Treatment or the study of diseases of old age.

gestation (jĕs-tā′shŭn). Period of fetal development. Pregnancy.

glycemia (glĭ-sē′mĭ-ȧ). Presence of an abnormally large amount of sugar in the blood.

glyceride (glĭs′ĕr-īd). A compound formed when glycerin and an acid are combined.

glycogen (glī′kô-jĕn). A carbohydrate, similar in composition to starch. In this form, carbohydrate is stored temporarily in the liver and the muscles.

glycosuria (glī′ko-sū′rĭ-ȧ). Presence of sugar in the urine.

hemeralopia (hĕm′ĕr-ȧ-lō′pĭ-ȧ). Day blindness; inability to see in a bright light.

hemicellulose (hĕm′ĭ-sĕl′û-lōs). Carbohydrate-like substance in the cell wall of plants. Indigestible, but it absorbs water, thereby stimulating laxation.

hemolytic (hē′mô-lĭt′ĭk). Pertaining to the breaking down of red blood corpuscles.

hemorrhage (hĕm′ŏ-rĭj). A copious escape of blood from the vessels; bleeding.

hemorrhoid(s) (hĕm′ŏ-roid). Vascular-like tumors of the rectal mucous membrane.

hepatic (hê-păt′ĭk). Pertaining to the liver.

histamine (hĭs′tȧ-mēn). A nitrogenous substance in the body found wherever tissues are damaged. A stimulator of the autonomic system and used to stimulate gastric secretion.

hormone (hôr′mōn). A chemical substance which is produced in an organ and transported to another organ, where it produces a specific effect.

hydrolysate (hī-drŏl′ĭ-sāt). A product of hydrolysis. Often applied to protein.

hydrolysis (hī-drŏl′ĭ-sĭs). A chemical reaction in which a compound is broken down with the absorption of water and the formation of a new compound.

hyperchlorhydria (hī′pẽr-klōr-hī′drĭ-ȧ). Excessive secretion of hydrochloric acid in the stomach.

hyperlipemia (hī′pẽr-lĭ-pē′mĭ-ȧ). Excess of fat or lipoids in the blood.

hyperthermia (hī′pẽr-thûr′mĭ-ȧ). Fever.

hypertrophic (hī′pẽr-trŏf′ĭk). Pertaining to an enlargement or overgrowth of an organ or part due to a diseased condition.

hypochlorhydria (hī′pō-klōr-hī′drĭ-ȧ). Diminished secretion of hydrochloric acid in the stomach.

hypophysis (hī-pŏf′ĭ-sĭs). Any outgrowth, especially referring to the pituitary gland.

icterus (ĭk′tẽr-ŭs). Jaundice.

idiopathic (ĭd′ĭ-ô-păth′ĭk). Pertaining to an abnormal condition or state of self-originated, unrelated cause.

incipient (ĭn-sĭp′ĭ-ĕnt). Beginning to exist.

inositol (ĭn-ō′sĭ-tōl). A member of the vitamin B complex.

intrinsic (ĭn-trĭn′sĭk). Situated entirely within; pertaining to itself.

isotopes (ī′so-tōps). Two or more chemical elements which have the same atomic number and identical chemical properties, but which differ in atomic weight or in the structure of the nucleus.

keratinize (kĕr′ȧ-tĭn-īz). To become horny-like.

ketogenic (kē′tō-jĕn′ĭk). Capable of being converted into ketone bodies. Ketogenic substances in metabolism are the fatty acids and certain amino acids.

ketosis (kê-tō′sĭs). A condition in which there is an accumulation in the body of the ketone bodies (*See* acetone bodies) as a result of incomplete oxidation of the fatty acids.

labile (lā′bĭl). Not fixed; unstable.

lacteal(s) (lăk′tê-ăl). Tiny vessels in the intestinal wall leading to the lymphatic system through which fat is absorbed.

lavage (lăv′ĭj). The washing out of an organ, such as the stomach.

lecithin (lĕs′ĭ-thĭn). A fatlike compound in combination with phosphorus. Found in animal tissues, especially nerve tissue.

leukemia (lû-kē′mĭ-ȧ). A disease of the blood-forming organs, characterized by a marked increase of the white corpuscles.

leukocyte (lū′kô-sīt). White blood corpuscles.

leukopenic (lū′kô-pĕn′ĭk). Pertaining to leukopenia (reduction of leukocytes in the blood).

lipid (lĭp′ĭd). Fat or fatlike substances.

lipoid (lĭp′oid). Fat or fatlike substances. Same as lipid.

macrocyte (măk′rô-sīt). Abnormally large red blood corpuscle.

malignant (mȧ-lĭg′nănt). Severe form of occurrence, tending to grow worse.

marasmus (mȧ-răz′mŭs). Wasting and emaciation, especially in infants.

matrix (mā′trĭks). The intercellular framework of a tissue.

menadione (mê-nă-dī′ōn). Vitamin K.

metabolism (mĕ-tăb′ô-lĭz'm). General term to designate all chemical changes which occur in living matter. These changes are of two types—constructive and destructive.

microcyte (mī′krô-sīt). An undersized red blood corpuscle.

mucosa (mû-kō′sȧ). Mucous membrane lining passages and cavities, as in the gastro-intestinal tract.

myocarditis (mī′ô-kär-dī′tĭs). Inflammation of the myocardium (heart muscle).

myosin (mī′ô-sĭn). A protein of muscle plasma.

myxedema (mĭk′sê-dē′mȧ). Condition due to a deficiency of thyroid secretion.

necrosis (nĕ-krō′sĭs). Death of a circumscribed area of tissue.

neurasthenia (nū′răs-thē′nĭ-ȧ). Nervous exhaustion characterized by abnormal fatigue.

neurogenic (nū′rô-jĕn′ĭk). Forming nerve tissue. Originating in the nervous tissue.

niacin (nī′*ȧ*-sĭn). A member of the vitamin B complex, formerly known as nicotinic acid. An antipellagra factor.

nucleoprotein (nū′klē-ō-prō′tē-ĭn). The conjugated protein found in the nuclei of cells.

nyctalopia (nĭk′t*ȧ*-lō′pĭ-*ȧ*). Night blindness; imperfection of vision at night or in a dim light.

ophthalmia (ŏf-thăl′mĭ-*ȧ*). Severe inflammation of the eye.

osmotic pressure (ŏs-mŏt′ĭk). Unbalanced pressure causing the phenomena of osmosis (the passage of a solvent through a membrane separating solutions of different concentrations).

ossification (ŏs′*ĭ*-fĭ-kā′sh*ŭ*n). Formation of bone or bony substance.

osteomalacia (ŏs′tē-ō-m*ȧ*-lā′shĭ-*ȧ*). Softening of the bone.

oxidation (ŏk′s*ĭ*-dā′sh*ŭ*n). A chemical process by which a substance combines with oxygen. In the body the rate of oxidation depends upon cell activity, not the intake of oxygen.

pantothenic acid (păn′tō-thĕn′ĭk). A member of the vitamin B complex.

parenchyma (p*ȧ*-rĕng′kĭ-m*ȧ*). The functional part of an organ as distinguished from its framework.

parenteral (păr-ĕn′tĕr-*ă*l). Not through the alimentary canal; i.e., subcutaneously or intravenously.

parturition (pär-tū-rĭsh′*ŭ*n). The act or process of giving birth to a child.

peptone(s) (pĕp′tōn). A protein produced by hydrolysis of a native protein. (*See* proteoses.)

pericarditis (pĕr′i-kär-dī′tĭs). Inflammation of the pericardium (membrane surrounding the heart).

peristalsis (pĕr′ĭ-stăl′sĭs). The wavelike movement by which the alimentary tract propels its contents.

pernicious (pēr-nĭsh′*ŭ*s). Tending to be serious or fatal.

polycythemia (pŏl′ĭ-sī-thē′mĭ-*ȧ*). Excess of red corpuscles in the blood.

polydipsia (pŏl′ĭ-dĭp′sĭ-*ȧ*). Excessive thirst.

polyphagia (pŏl′ĭ-fā′jĭ-*ȧ*). Excessive hunger.

polyuria (pŏl′ĭ-ū′rĭ-*ȧ*). Excessive secretion and discharge of urine.

precursor (prē-kûr′sēr). A substance which is converted into another.

prognosis (prŏg-nō′sĭs). Prospect as to recovery from a disease.

prophylaxis (prō′f*ĭ*-lăk′sĭs). The prevention of disease.

proteinuria (prō′tē-ĭ-nū′rĭ-*ȧ*). Presence of protein in the urine.

proteolytic (prō′tē-ō-lĭt′ĭk). Effecting the digestion of proteins.

proteose(s) (prō′tē-ōs). An intermediate product of enzymatic hydrolysis of protein between protein and peptone.

protoplasm (prō′tō-plăz′m). The essential living matter in a cell. The only known form of matter in which life is manifested.

provitamin (prō-vī′t*ȧ*-mĭn). The forerunner of a vitamin; provitamin A is carotene.

psoriasis (sō-rī′*ȧ*-sĭs). Skin disease characterized by formation of scaly red patches.

purine(s) (pū′rēn). End products of nucleated protein digestion.

putrefaction (pū′trē-făk′sh*ŭ*n). The decomposition of animal matter, especially protein, caused by certain kinds of bacteria.

pyelitis ((pī′*ĕ*-lī′tĭs). Inflammation of the kidney and its pelvis.

pyridoxine (pī-rĭ-dŏk′sĭn). Vitamin B_6, a member of the vitamin B complex.

radiography (rā′dĭ-ŏg′r*ȧ*-fĭ). Photography with the roentgen rays. The making of x-ray pictures.

remission (rē-mĭsh′*ŭ*n). The period of abatement of symptoms or the lessening of severity of them.

rennin (rĕn′ĭn). The milk-curdling enzyme of the gastric juice.

reticulocyte (rē-tĭk′ū-lō-sīt′). A young red blood cell.

retina (rĕt′ĭ-n*ȧ*). Innermost and the perceptive structure of the eye, formed by the expansion of the optic nerve.

riboflavin (rī′bō-flā′vĭn). Vitamin B_2 or G; heat-stable factor of B complex.

saponification (sȧ-pŏn′ĭ-fi-kā′shŭn). The splitting of fat by an alkali, yielding glycerol and soap. This may occur during the digestion of fat.

satiety (sȧ-tī′ĕ-tĭ). Fullness or gratification of the appetite.

sclerosis (sklê-rō′sĭs). Hardening, a chronic thickening of a part due to inflammation and disease.

spasmophilia (spăz′mō-fĭl′ĭ-ȧ). A tendency to spasm and convulsions.

spastic (spăs′tĭk). Characterized by spasms or convulsions.

sphincter (sfĭngk′tẽr). A ringlike muscle which closes a natural opening.

stasis (stā′sĭs). A stoppage of the flow of blood or other body fluid in any part.

steatorrhea (stē′ȧ-tō-rē′ȧ). Presence of an excess of fat in the stools.

sterol (stĕr′ōl). Fat-soluble substances of a complex molecular structure.

syndrome (sĭn′drōm). A set of symptoms which occur together.

synthesis (sĭn′thê-sĭs). The process of building up; union of broken or separated structures.

tetany (tĕt′ȧ-nĭ). A condition characterized by intermittent spasms, muscle twitchings and cramps usually involving the extremities; most frequent in the young.

thiamine (thī′ăm-ĭn). Vitamin B_1. Antineuritic factor.

thiochrome (thī′ō-krōm). The yellow coloring matter of yeast. It may be prepared by oxidizing thiamine.

tocopherol (tō-kŏf′ẽr-ōl). An alcohol-like substance which has the properties of vitamin E.

trauma (trô′mȧ). An injury or a wound.

trichinosis (trĭk′ĭ-nō′sĭs). A disease due to infection with trichinae—parasites found in raw pork.

ultraviolet light (ŭl′trȧ-vī′ō-lĕt). Rays of shorter wavelength than visible light. Sunlight is the natural source, but it may be derived from various kinds of electrical devices.

urea (û-rē′ȧ). The chief nitrogenous end product of protein metabolism in the body.

uremia (û-rē′mĭ-ȧ). Toxic condition produced by the presence of urinary constituents (waste products) in the blood.

urobilinogen (ū′rō-bī-lĭn′ō-jĕn). An excretory product in the urine derived from one of the bile pigments. Bile pigments are derived from degenerated hemoglobin.

urticaria (ûr′tĭ-kā′rĭ-ȧ). Hives, nettle rash.

vascular (văs′kû-lẽr). Pertaining to or full of vessels.

viosterol (vī-ŏs′tẽr-ōl). A solution of irradiated ergosterol in oil, vitamin D_2.

xerophthalmia (zē′rŏf-thăl′mĭ-ȧ). A dry and lusterless condition of the eyes resulting from a vitamin A deficiency.

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